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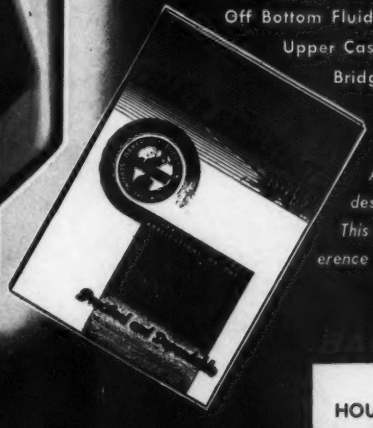

LOS ANGELES, CALIFORNIA
HOUSTON, TEXAS NEW YORK, N. Y.

BAKER CEMENT RETAINER

Vol. 33
No. 20
Whole
No. 1571

IMPORTANT NOTICE

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THE AUTHORITY ON THE CALIFORNIA OIL INDUSTRY

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Review of Advancements in California

Drilling Practices for 1940

Fall Meeting
1940 A. I. M. E.

By A. H. Bell
Continental Oil Co., Los Angeles, Calif.

Any attempt to review the new methods and equipment used in oil well drilling must necessarily cover a range greater than one year. Some ideas are conceived in a given year but do not reach their peak of popular acceptance until one or two years later. This paper will attempt to outline the developments of major interest that have occurred during the past year without regard to the actual dates of their inception.

For many years drilling equipment has been largely of the same size and capacity, the variations being limited to refinement of design. As improvements developed it was the practice of operators to use their older equipment on shallow drilling projects and to use the new equipment on deeper wells.

Since discovery of the extremely deep fields in the San Joaquin Valley there has been a definite trend toward the development of large and heavy equipment to drill to deepest levels at high speed. This development reached its peak during the past year with the introduction of the 500-pound steam pressure superdrilling rig which was designed and built to meet the specifications of Superior Oil Company. This rig has been described in detail in the trade journals but the outstanding features will be discussed later in this paper.

The development of extra heavy drilling equipment for great depths has naturally been followed by higher depreciation costs on this more expensive equipment and the operators have been forced to drill at greater speeds even against the handicaps of greater depths in order to hold down overall drilling costs. This trend for the past ten years is clearly shown on Plate I.

It is interesting to note from the graph that although costs per drilling rig day have increased tremendously during the past ten years, the number of feet drilled per day has also increased in face of the greater average depths drilled. The figures used include those from wildcat wells where lost time in coring and testing reduced the average drilling speeds.

Drilling records for speed have been continually broken in spite of increased depth but on the other hand records for low production allotments under California's pro-ration plan have been steadily broken. California operators are therefore beginning to feel the pinch of diminishing returns from new wells drilled. Mid-Continent operators have been severely curtailed for several years and as a result have been forced to develop methods for lowering drilling costs.

The necessity of reducing costs has been well covered in the article entitled "Prorated Production at Minimum Profit Level," by Wm. H. Strang in the Oil Weekly of July 29, 1940.

One method of lowering costs has been "slim-hole" drilling and this method has been adapted to 8000-foot drilling operations in San Joaquin Valley by Shell Oil Company. Other operators are being influenced to adopt similar or compromise methods.

Proponents of slim hole programs recognize the fact that pumping difficulties caused by small casing will be encountered in the future when the wells cease natural flow. They believe that because of wide spacing and heavy curtailment programs, the natural flow period will be prolonged. Pressure maintenance possibilities furnish further protection as a means of prolonging flow. In addition many operators feel that it is better to keep solvent today and let the future meet its own problems.

The greatest saving in the "slim-hole" program is through reduced size of casing, the water string usually being 5 inches in diameter. One operator is experimenting with the use of 4½-inch O.D. tubing for

Time out for a little stretch at A.I.M.E. sessions.

drill pipe and then cementing the tubing in for casing, thus doing away with drill pipe investment and maintenance. The requirement of the California State Division of Oil and Gas for protection strings cemented over upper oil zones offers some difficulty in planning reduced well costs. Many operators have lately been seeking modification of these rules claiming that cementing and mudding practices have been greatly improved since the rules were laid down in earlier years and that the upper zones can now be effectively protected by mudding and cementing behind one water string.

As a result of the growth in popularity of the "slim hole" programs, many manufacturers of drilling equipment have recently introduced light weight, low cost equipment together with semi-portable derricks.

Another means of reducing drilling costs which has recently gained favor in California, is the use of internal combustion engine semi-portable rigs for depths usually of 7500 feet or less. Tool manufacturers have been able to improve their designs through the experience gained in development of similar outfits in fairly large sizes for export for foreign drilling operations. The internal combustion engine rig has been brought into more active competition with the steam rig by the incorporation of a hydraulic coupling in the shaft to absorb shock between the engine and the pumps or drawworks. The hydraulic coupling transmits a constant torque at reduced speeds when sudden loads are developed and furnishes excellent protection for mud pumps in the event of discharge stoppage. It also assists in synchronizing speeds when pumps are compounded. The hydraulic torque converter, which transmits increasing torque at lower speeds, is ideal for drawworks use as its torque and speed-changing ratio varies automatically through a range or 4 to 1 and therefore a two-speed drawworks of simple design can be used. The only present limitation is that larger sizes have not as yet been developed.

The friction clutch has also been perfected to a point where the jaw clutches can be eliminated in heavy internal combustion engine-driven drilling rigs for all but the low speeds. The super rig previously referred to is equipped with an air controlled friction clutch and has demonstrated that this type of clutch can be used for very heavy loads.

The arrangement of three engines so that in pulling out of the hole, one of the pump engines can be connected in parallel with the drawworks engine is becoming well established as a standard design by various manufacturers. The former practice of attempting to adapt internal combustion engines to drawworks designed for steam has been supplanted by drawworks designed with friction clutches, enclosed chain or gear box transmissions and reduced number of shafts. As a result of these and other improvements costs have been reduced and portability improved, and it is the opinion of the writer that these units designed for drilling depths and drill pipe weights to suit various districts will find increasing use in California oil fields.

In any investigation of drilling costs one fact stands out with startling clearness. The cost of drilling equipment is too high but the fault does not lie entirely with the manufacturers. The evolutionary period in drilling tool design that we have been going through has produced unbelievable results in drilling efficiency improvement, but it is high time that some standardization of equipment is attempted for the purpose of reducing manufacturing costs. The ink is hardly dry on a catalogue before the item becomes obsolete because the next customer has demanded certain changes in design. If the drilling branches of the various companies would cooperate with the manufacturers to the end that hand tailored equipment were eliminated, great strides in the reduction of drilling tool depreciation costs could be made.

In a survey of new developments in the way of individual tools or equipment the first item to consider is the drilling derrick in which little

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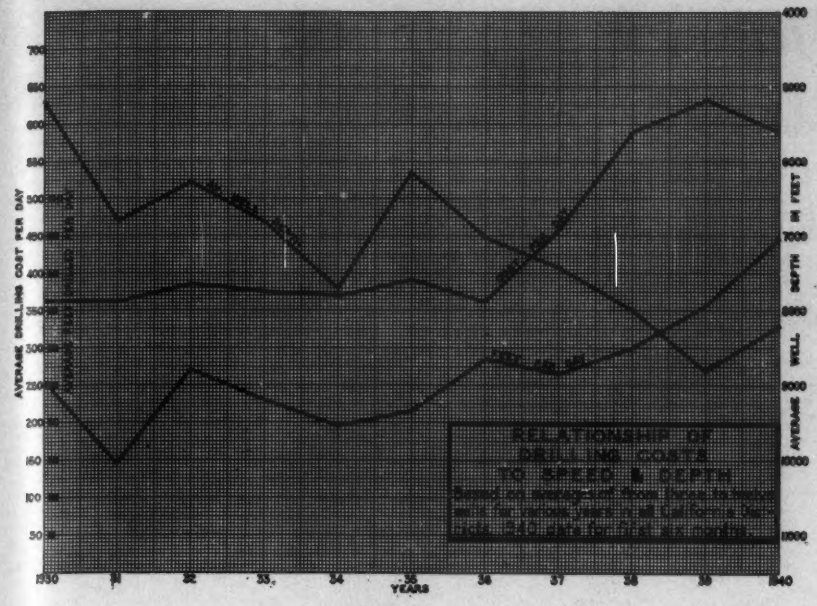

Plate No. 1.

change has been made except that the use of the eight-foot, three-inch high derrick floor has become the rule rather than the exception. Steel substructures for the high floors have become fairly well standardized and portable steel casing racks are coming rapidly into favor.

The practice of moving derricks from well to well has become prevalent in new fields where curtailment restrictions and wide spacing insure long flowing life for the wells. This new practice for California has caused a definite trend toward streamlining the rig equipment into portable units that can be readily moved and reassembled. Shell Company and Signal Oil and Gas Company have each developed systems whereby grillages of steel beams are used to eliminate concrete derrick foundations.

The steam driven super drawworks previously mentioned as designed for Superior Oil Company is a fully-enclosed 3-shaft, 3-speed outfit with a 32-inch diameter by 58-inch drum having a 62x10⅜-inch brake rim. The old conventional arrangement of chain drives was modified so that the high and intermediate speed drives are direct from the jack shaft to the drum shaft, with one drive on each end of the shaft. The low speed, which is seldom used, is accomplished through chains up to the line shaft and back to the jack shaft.

Another feature is the 40-inch double-rotor hydromatic brake to handle the heavy loads. This drawworks with its 15x14-inch, 500-pound steam engine can handle all but the heaviest loads in high gear with consequent reductions in pulling time. Further experience will be required, however, to determine whether the value of the time saved offsets the greater depreciation and moving costs.

Following the introduction of this large drawworks, a newly designed drawworks was delivered to Continental Oil Company, equivalent to the old 34-26 drawworks but embodying many of the new design features developed in the super drawworks. It is a four-speed outfit and the jack shaft to line shaft drive was put outside of the posts thereby allowing the line and jack shafts to be brought closer to the drum making a more compact unit with greater accessibility to brake rims.

This outfit has been coupled with a vertical engine set at the casing rack level, driving up at an angle to the drawworks on the derrick floor level. The high-speed rotary table is driven from the drawworks at moderate speeds so that the engine operating on early cut-off has low steam consumption at the time when the pumps cause peak load on the boilers.

Boiler plant design has undergone little change in the last year and except for the 500-pound, 130-horsepower boilers developed for Superior Oil Company the industry at large has adopted the 350-pound, 125-horsepower boilers.

An analysis of the boiler failures which have occurred in the last few years since high pressures have been introduced, indicates that bad water is the primary cause. The inability of the locomotive type boilers now in use to handle large overloads continuously, together with the necessity of standby boilers for use during periods of shutdown for cleaning, may also be attributed to bad water.

In order to overcome this difficulty and to insure an adequate supply of steam at all times, Continental Oil Company has ordered a new boiler plant for San Joaquin Valley drilling, consisting of marine-type water-tube boilers with evaporator, condenser, and cooling towers so that the plant will run on distilled water.

The plant includes two boilers mounted on skids with overall measurements of 8x15x13 feet, the two boilers being connected to one steel stack 5 feet in diameter by 70 feet high. The feedwater tank, evaporator, condenser, feed and circulating pumps are mounted on two sets of steel skids and are completely piped so that flanged headers are used to connect between the two units. Three portable cooling towers 8x25-x12 feet are used to cool the condensing water. All exhaust steam from the pumps and engine is returned to the condensers allowing about 10 per cent for the total steam load as leakage and waste to be evaporated from raw water.

The two boilers will have a normal capacity of 35,000 pounds of 350-pound superheated steam per

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hour with either boiler having capacity to furnish the entire load for short periods. The boilers will run continuously until completion of the well and will only require cleaning and inspection between wells.

Another tool innovation is the replacement of the conventional rotary hook member by a yoke from which the elevator links are suspended. A special adapter or connector of similar shape to the section of drill pipe and tool joint is attached to the swivel bail and provides a means of supporting the swivel by the regular elevator instead of a hook while drilling. Drill pipe is handled in the usual manner.

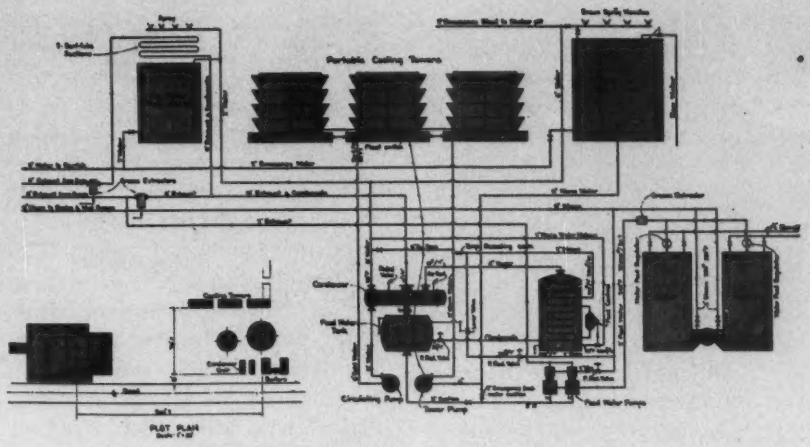


Plate No. 2. Flow Diagram of Marine Type Boiler Plant.

The advent of deeper drilling has influenced the design of narrower traveling blocks to give more clearance in the derrick when racking long strings of drill pipe. One type which is a departure from the basic design of traveling and crown blocks has been successfully developed. In this type the conventional bearings have been replaced by a hollow manganese steel drum which supports the steel sheaves and about which the sheaves revolve on roller bearings. All working parts are in-

As usual, the A.I.M.E. registration desk is a busy place during the Fall meeting.

terchangeable between the crown block and the traveling block.

New pipe tongs have been developed which can handle drill pipe or drill collars with a range of diameter from 4½ up to 9⅝ inches by simply changing one or two of the hinged jaws, thereby saving time and eliminating the storage of heads for each size of pipe.

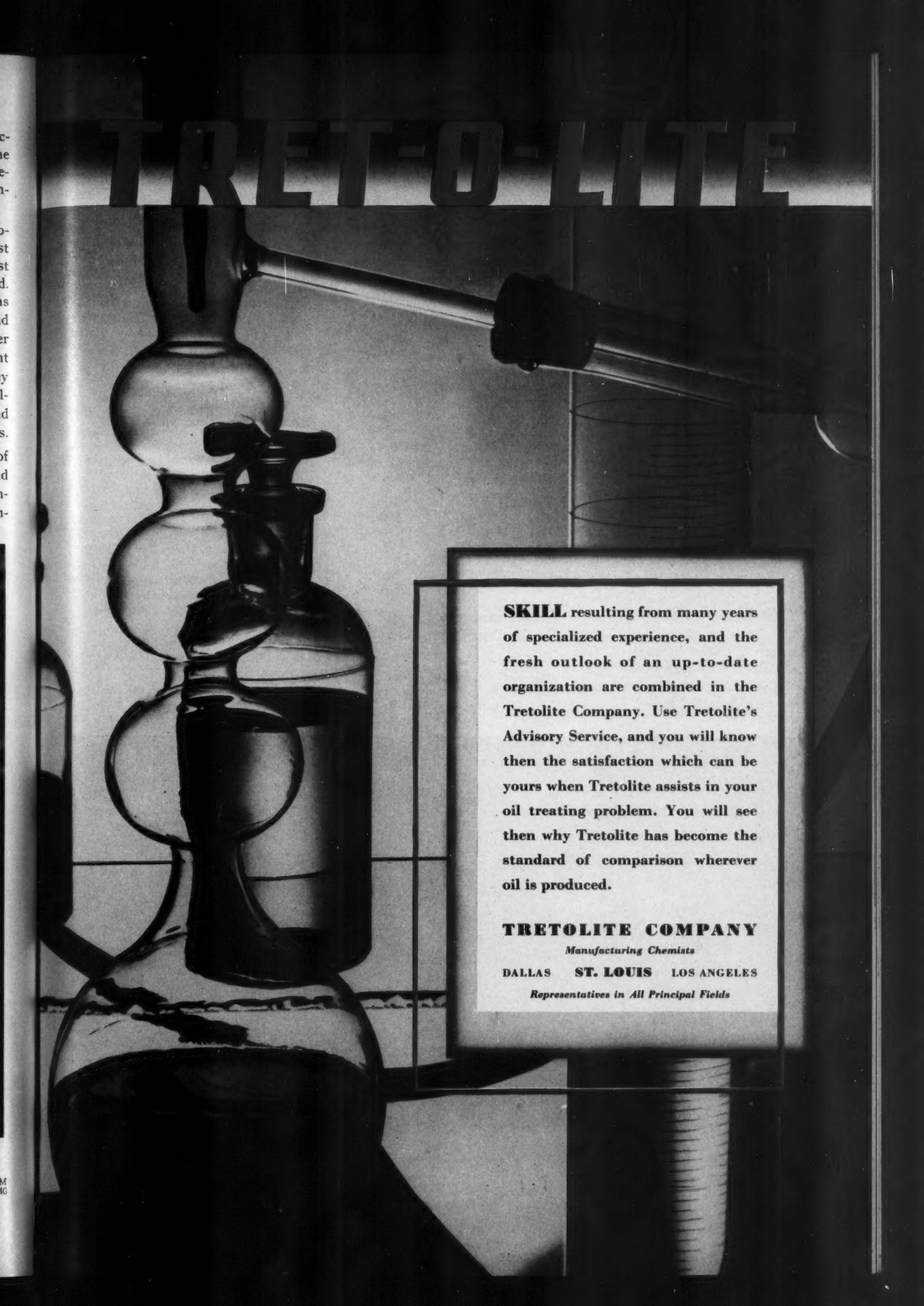
The race for supremacy between manufacturers of drill pipe and tool joints still continues. The reduction in joint failures indicates that the drilling industry has definitely benefited by its break away from the old standard tool joint. A new improved standardized joint will no doubt be evolved from the many types of patented joints, threads and variations in upset practice, which will simplify the operator's problem of trying to determine which of the many joints now offered is superior. Since the development of the integral joint, the trend to larger external upset diameters than formerly used and the introduction of new thread designs whereby the joints are made up tight to a shoulder, has caused the number of twist-offs to be greatly reduced. A new item of cost has developed however from the excessive wear on the larger diameter joints and many methods of rebuilding the joints have been tried. A new development this year is the method of replacing the worn joint with a new tool joint flash welded onto the upset of the pipe.

Cementing practice has been gradually improved both as to cementing wagon efficiency and control of slurry characteristics. It is now possible for an operator to specify the weight, per cubic foot, of the slurry for various stages of the cement job and the cementer can comply with reasonable accuracy.

Bulk cementing has been introduced in California during the past year as a means of facilitating fast jobs where large quantities are used. Bulk cement is stored in large bins or hoppers at strategic points and tank trucks equipped with power conveyors for displacing the cement into the mixers are used to convey the cement to the job, thereby eliminating unloading, storing and dumping of cement by extra crews.

Significant changes in methods of controlling drilling performance and interpretation of formations encountered by the use of scientific in-

The speakers need not "talk down" for these A.I.M.E. boys.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struments have recently been developed.

The original weight indicator has gradually been enlarged in scope so that the latest instruments also include indicating and recording gauges for rotation speed, torque and mud pressure. It is possible for the drilling supervisor to analyze the recording charts to determine the causes of fishing jobs or equipment failures.

Most wells drilling in areas where mud is an important factor in the control of formation trouble, are equipped with compact metal cabinets which constitute small laboratories for testing mud. The tests usually made are for viscosity, weight, shear strength, sand content and fluid loss. The use of chemicals to control these various properties is becoming prevalent and as a result a new job has been created for "mud engineers." As the cost of materials for mud sometimes runs as high as $25,000 for one well it can be seen that scientific mud control is highly important. New instruments for automatically recording mud properties are being developed and some are now available for use.

To avoid the human element inherent in the visual inspection of cores or ditch samples new methods have been perfected to record formations mechanically. The established method of electrical logging has now been supplemented by services whereby continuous analyses of the circulated mud returns for oil and gas, together with penetration rate are made at the well in trailers equipped as laboratories. Other services make complete analyses of cores for hydrocarbon content and physical characteristics in a trailer laboratory at the well.

A great deal of experimental work has been done to locate gas, water or thief sands in wells by means of temperature surveys. Results of this work indicate that this method is quite successful and services of this nature will soon be available to all operators.

New Company Formed For Devils Den Operations

Headed by H. C. Trigg, the newly organized Pennsylvania Lube Oil Co. will operate properties in sec. 11,25-18 formerly owned by Mr. Trigg as an individual. Located in the Devils Den-Pyramid Hills area, the original well on the property is making 65 bbls. of good lube stock oil while the second has been completed, pumping a like amount from 954 ft. The company plans to start well No. 3 within 30 days.

An interesting feature of operations in well No. 1 is the fact that fresh water pumped with the oil is used in the boilers, a valuable addition to water stocks in this arid country. The oil sand here is topped near 690 ft. after passing through water sands at 150 ft. from which the usable water comes.

Two Wildcats Drill In Santa Barbara Co.

At one of its periodic ebbs is wildcat activity in Santa Barbara county with only two tests drilling. At Coal Oil Point, Bolsa Chica Oil Corp. seems to be in the clear at last after having difficulty in getting away from the old holes on Permit No. 191. Vaqueros production is sought.

The Oil Group, Inc.-Barnato Corp. well at Summerland, which has worked intermittantly for two years, is coring below 3420 ft., reportedly in Sespe.

Lester L. Pederson drilled two core holes at Carpinteria, the deepest to 115 ft., in attempt to locate a possible structure.

Union Oil Co. is preparing to spud its semiwildcat, Bell No. 11, near the edge of the old Cat Canyon field.

It took the cameraman two shots to get this batch of A.I.M.M.E. authors and officials. Reading from left to right across these pages, you will identify A. H. Bell, C. P. Watson,

Many Timely Papers Feature A. I. M. M. E.

Fall Meeting in Los Angeles

Active discussions of a wealth of timely and informative papers gave proof that some five hundred petroleum engineers and technologists did well to take time out October 17-18 to attend the Fall meeting of the American Institute of Mining and Metallurgical Engineers, in Los Angeles. High points in the proceedings are here presented.

R. E. Collom, president of the California Oil & Gas Association, discussing the Oil Industry, said:

"An industry which in the past 60 years has produced one-fourth of the mineral wealth of the United States; which in the past five years has found new reserves of 12,160,000,000 barrels, equal to the total production of oil in the United States during the first 70 years of the oil business; which is currently adding nearly two billion dollars a year to the value of minerals produced; which as an energy source, creates one-third of the power in the United States; drives automobiles, bunkers ships, furnishes heat, light and power; lubricates everything; provides employment to over a million Americans; pays annually over a billion and a quarter dollars in Federal, State and other taxes and meets every need of the consuming public with an abundance of products at price indexes consistently lower than the price indexes of all other commodities, is deserving of better treatment than political exploitation through false pretenses and innuendo.

"Truly most vital to national defense the petroleum industry is prepared and ready to furnish almost unlimited quantities of fuel for planes, ships, and tanks. Why do not the executives of Government take a cue from its engineers and approach the petroleum industry in a friendly and cooperative spirit with the object of determining where and how Government can best serve industry and industry can best adapt itself to needs of Government in preparing for our national defense and the continuance of our American destiny."

E. Huguenin, deputy state oil and gas supervisor, and Harry P. Stolz, consultant to the Attorney General, in outlining the history of the operation of the Gas Law in the West Montebello oil field, said:

"Immediately following the last reduction in the gas allotment, some reduction in oil production resulted. This generally righted itself to the new producing conditions within a few weeks, so that a large majority of wells continued to produce practically as much oil under the new allotment as they did under the previous one. It was also found that in a number of cases increased gas/oil ratios were attributable to the poor mechanical manipulation of wells. As an example a well is cited which under its last allotment was producing 28 to 32 barrels of oil. In an attempt to increase the oil production the operator continually changed the bean, thus disturbing the equilibrium of pressures in the well. On the recommendation of both committees and with the consent of the operator, this well was placed under the supervision of the State engineers for a limited period. The bean was adjusted to produce only its gas allotment and allowed to produce undisturbed. Within a period of five weeks the oil production had gradually increased to an average of 68 barrels per day. It now appears that a substantial further reduction in gas production could be effected without materially decreasing the oil production.

"In conclusion, results obtained by the injunction suit may be summarized as follows:

"First and most important: Conservation of gas energy has led to a longer flowing life of the individual wells and therefore the field as a whole, increasing the ultimate recovery of oil.

"Second: A saving to the operators in production costs and increasing their ultimate revenue thereby. If the total field blow had been allowed to continue at

James A. Lewis, T. A. Atkinson, T. V. Moore, Richard Pence, Joseph Jensen, Chester Naramore, C. J. Coberly, Harry Stolz, Tracey Atherton, Barney Koogle, Stark Fox and William Geis.

Officiating or authoring in the Friday sessions were Richard Pence, R. P. McLaughlin, H. K. Armstrong, Walker Clute, Milton Lewis, C. J. Coberly, Graydon Oliver.

100,000 M.C.F. per day, valued at 4c per M.C.F., the value of the gas thus blown would have approximated $600 per well per month, or considerably more than the monthly operating cost of the average well.

"Third: The saving to the ultimate consumer—the People of the State of California—some of their irreplaceable natural resources, great quantities of natural gas, the value of which would be in hundreds of thousands of dollars.

"Fourth: The education of the majority of operators at West Montebello oil field as to the benefits derived by the conservation of the gas energy, whose cooperation was first forced, but who now value these benefits.

"Fifth: This action upon the part of the State and the cooperation obtained between the Court, State enforcement agencies, and the operators, should point the way to a solution in other fields that may become potential gas wasters. Such a solution should be reached by the voluntary efforts of the operators concerned, without the need of Court action."

In his discussion of "Changes in Natural Gasoline Manufacturing," William Roper, of Western States Gasoline Corp., pointed out that:

"Research and the development of newer processes have made it possible to manufacture super-fuels, having octane ratings from 90 to 125 from fractions in the liquefied petroleum gas range, for use in aviation and motor gasolines. These processes are known as 'aromatization,' 'polymerization,' and 'alkylation.' While these processes are primarily chemical and refining operations, they utilize gaseous hydrocarbons which can be recovered from natural gas, or products which can be made from such gases by thermal or catalytic dehydrogenation or by isomerization.

"In the polymerization process lighter hydrocarbons of the olefin or unsaturated series are caused to unite to form heavier hydrocarbons. In operation with natural gases, the gases are first dehydrogenated to olefins (unsaturates) either thermally or catalytically and, second, the olefins which are thus formed are polymerized to gasoline in the motor fuel range.

"Aromatization is the conversion of saturated, or natural gases to aromatics, such as benzol, toluol, zylol. The aromatics have particular significance for the production of explosives. Gasolines containing aromatics have high anti-knock value.

"The term alkylation, as used here, is the process in which a selected paraffin (iso-butane) unites with olefins to form gasoline of high anti-knock value. Two types of processes are in use, one thermal, the other catalytic.

"The thermal process is conducted in two steps. Developed by the Phillips Petroleum Company, it first de-hydrogenates ethane and propane at high temperature and low pressure under conditions favorable to the formation of ethylene (an unsaturate, or olefin). Ethylene and iso-butane are then alkylated at high pressure and temperature to form an alkylate having an octane rating of 82-83 from which neo-hexane, having an octane rating of 100, can be fractionated.

"In present commercial catalytic alkylation plants, propylene-butylene mixtures, or butylene-pentane mixtures, are commingled with iso-butane in the presence of concentrated sulphuric acid. The product obtained in the motor fuel range is reported to be more nearly a finished aviation gasoline than is iso-octane. This process is reported to be particularly economical for the production of aviation gasoline as compared to older methods.

"The manufacture of aviation gasoline on the Pacific Coast by alkylation was, until recent developments, limited by the volumes of butylene-propylene available from refinery cracking gases, but the potential volumes of these products now made available by dehydrogenation of natural gases, or by reforming straight run gasoline, will make possible the manufacture of larger volumes of high anti-knock gasoline, dependent upon economic conditions, such as crude reserves, price, demand, etc.

"Of the two general methods of operation now used for recovery of the distillate, one is that of high pressure absorption. Plants are now in operation at pressures up to 1500 pounds, and future plants may exceed this pressure.

"The other method used is that em-

R. T. Carter, W. W. Lacey, B. H. Sage, Horace Hindry, E. K. Soper, and F. G. Tickell. Among those who attended by proxy were Rush Blodget, R. E. Collom, Paul Paine.

ploying the principle of retrograde condensation. These principles are not new, having been previously used in practice but the term "retrograde" has only been recently adopted.

"The principles of retrograde condensation can be understood better from a simple explanation of the phase-relations of a gaseous mixture when subjected to changes in pressure and/or temperature. There is sufficient technical data to calculate the behavior of simple gaseous mixtures, but for complex mixtures such as are found in reservoirs, the limits of liquid phase and vapor-liquid phase must be determined experimentally. From experimental results a curve can be made for the mixture indicating at what points of temperature and pressure the mixture will exist at 100% liquid, 100% vapor, or as a vapor-liquid mixture. Gas mixtures have been found existing under conditions for which

"(a) No change in pressure will cause condensation, but for which condensation would be caused by lowering the temperature.

"(b) Condensation would be caused by either decrease in temperature or decrease in pressure, or both."

Discussing "The Effect of Curtailment on Local Taxes," Walker S. Clute and Milton W. Lewis, geologists and engineers, described in detail a method of arriving at proper values of heavily curtailed properties and wells, and concluded that:

"It is believed that by detailed analysis as described herein the proper values of heavily curtailed properties and wells that will be shut-in for many years can be demonstrated satisfactorily.

"The result of our analysis is that apparently the factors as employed do result in assessment values commensurate with values obtainable on curtailed wells by direct but detailed appraisal of curtailed production; but that even so, both the assessor's methods and analytical appraisals show that top-allotment wells do have annual present values which, when added together over the lives of the wells, exceed the annual values of the same wells if they produced at open-flow rates. Hence the total taxes paid on curtailed wells are certain to be higher—in many cases twice higher—than the total taxes that would otherwise be paid. Any relief from this lies in the best recognition of these circumstances that can be granted by the taxing authorities, so that no mistakes be made in any case toward the higher side of the valuation found for tax purposes."

Rush M. Blodget, executive vice president of the Oil Producers Agency, discussed "The Functions of a Trade Association." Mr. Blodget said:

"I myself do not know what the term 'public relations' means. It seems to be a catch-phrase covering many things including the following:

"Press relations; employee relations; interindustry relations; governmental relations; political relations; lobbying; relations with the general public.

"The term may include all of the above; or it may include none. Mere newspaper publicity is of no use to an industry. Electing friends to office is a personal matter. Waiting for a bill to get into Committee and then popping up and making a speech is of little use. Mere backslapping, oratory and ballyhoo do not help an industry.

"But a fully integrated program, on large or small scale, with a definite objective, can be successfully carried out with the expenditure of the same energy.

"It matters not if the trade association is small, and the task large. If it furnishes the idea, the energy, the courage and the spirit, the task will be carried out somehow. My own association does it by sponsoring special corporations or groups to carry on. For instance, our Safety program was taken over by a separate corporation; our tideland problem by another; our insurance by another; and other movements were taken over by committees and groups, separately financed, wholly divorced from us, and carried through successfully.

"The objective should be broad. It should unselfishly encompass not only one's own association, but all units in the same industry. It should never shoulder off a load to the backs of another industry. It should keep in mind the welfare of all industry—of all men—and of the entire state."

Concluding his discussion of "The Characteristics and Application of an Oil Base

Every oil man should see this ad — run it again!

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This 30 horsepower electric gathering pump installation at Huntington Beach has been on the job *15 years* without costing a cent for repairs! And the only item of maintenance was a coat of glyptol varnish applied to the motor windings. When you buy an electric motor, you buy long years of dependable, trouble-free pumping service at the lowest possible cost. No other power unit can equal the over-all operating economy of electric motors. That is one reason why so many operators are switching to electric power for pipe-line and well pumping. Call your Edison office for complete information about low cost electric pumping.

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10-40

Mud," Horace W. Hindry, of Shell Oil Co. Inc., said:

"The costs for drilling with oil base muds are largely determined by the amount of care exercised in preventing waste and contamination of the mud. In general the costs are higher than when drilling with water base mud.

"It is not the purpose of this paper to attempt to justify the use of oil base muds; however, a few general remarks which bear on the problem can be made. In view of the excellent plastering properties of oil base mud when properly proportioned, its use should:

"1) Minimize the possibility of impairing the natural flow potentialities of the producing horizon such as that resulting from infilteration of water from water base muds;

"2) Permit smaller clearances for setting liners since the mud sheath has no appreciable thickness;

"3) Eliminate the possibility of clogging the perforations of the liner with thick mud sheath;

"4) Facilitate the removal of the mud sheath from the walls of the hole, for its mud sheath has no appreciable strength;

"5) Assist in drilling through formations, such as 'heaving shale,' where water wetting appears to be a source of difficulty;

"6) Permit cores to be obtained without contamination from drilling water."

One of the outstanding presentations of the meeting was that of E. W. McAllister, production engineer for the Kettleman Hills North Dome Association. His paper, which it is hoped will be released for fuller presentation in these columns at an early date, covered "Development and Application of Subsurface Pressure Data in Kettleman Hills." In concluding Mr. McAllister said:

"During the past year a plan for pressure maintenance by gas conservation was put into effect in the southeast end of the field. Such a plan has never been tried in the northwest end of the field because it has not been possible in this end of the field to obtain the cooperation of all operators upon which the success of a plan of this nature depends.

"Void volume calculations of the Temblor productive sand bodies and data on oil recoveries from fields having reservoir pressure maintenance programs indicate that had all the operators in Kettleman Hills agreed originally on a plan of pressure maintenance by gas conservation, the ultimate oil recovery from all properties would likely have been increased materially.

Summary

"The development and application of subsurface pressure data have given the production engineer an understanding of reservoir pressure conditions and a method of evaluating the ability of a well to produce which he has not had before. It has enabled him to determine the effect of various production policies on the field, to determine more accurately the potential and potential decline of wells, and to select to a better advantage equipment suitable for the production of each individual well. These and numerous other applications have made subsurface pressure work a routine part of production engineering."

Norwood Well Out of Woods

Norwood Oil Co.'s second well in the old field between Ojai and Santa Paula is now out of the woods after having to back up nearly to the surface to sidetrack collapsed casing. Located in sec. 17,4-21, last reported depth was 1650 ft.

The personnel of this company plan to drill near Fillmore under the name of Havlin & Pottenger.

Per-Col Oil Co. suspended operations in its Santa Paula area well, Anlauf No. 6, when no fluid entered the hole after bailing and acidizing.

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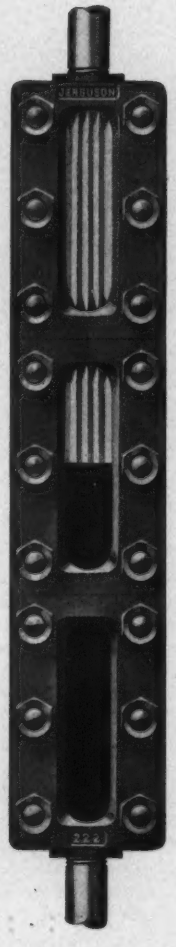

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Underground Surveying and Directional Control of Drilling Wells

By Wallace A. Sawdon
Petroleum Engineer, Los Angeles

Somewhat more than fifteen years ago underground surveying of oil wells was introduced to the petroleum industry. Since that time the importance of knowing where a hole actually goes during its course from the surface of the ground to its position in the producing zone has led to the development of instruments and drilling technique that provides for controlling the course of the bore as it is being drilled. Control of the course is usually for the purpose of keeping the hole vertical so that it will reach the producing zone as directly below the mouth of the well as possible. There are many circumstances, however, that make it desirable to locate the well on the surface at some place horizontally distant from the point where the well is to tap the producing zone and to control the course of the hole so that it will bottom at the predetermined location in the sand.

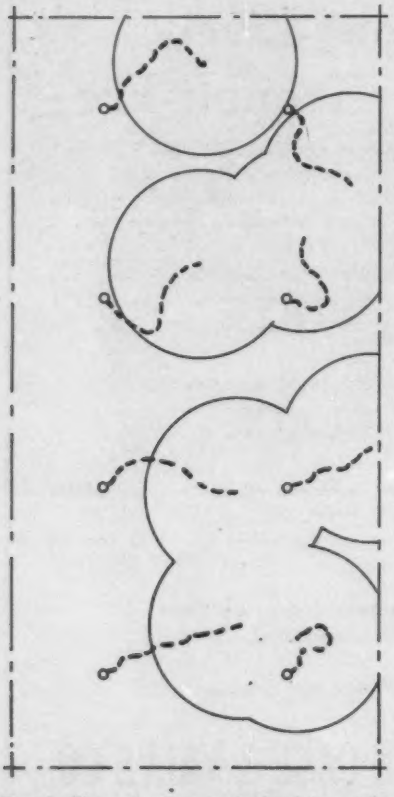


Fig. 1. The actual area drained by eight old surveyed wells on an 80-acre tract is here indicated by circular lines. Drainage areas for each well are based on assumption of effective drainage by well spacing on surface.

Underground Surveys

Surveys made of completed or partially completed wells show the courses of the wells below ground and provide a means of determining the location of any point in the well both horizontally and vertically with reference to the well head. By means of these surveys the vertical depths to various formations are secured and data furnished for geological correlation and structure contouring. The actual position of the well on the structure is also determined. Lease requirements and the allowing of a hole to drift too far during drilling often necessitates the survey of a well. In many cases, wells progressively surveyed during drilling are checked with complete hole surveys.

Old wells drilled before more attention was paid to control of their course while drilling should be surveyed before any recompletion or repair work is started. Surveys made of a number of old wells will in themselves often disclose the necessity for recompletion work. An example of this is shown by Fig. 1 where the wells on a lease have reached the sand at points far distant from properly spaced locations although the surface locations of the wells were laid out with great care. By plugging back and using directional drilling methods such wells can be recompleted and proper drainage of an area secured, frequently by redrilling only some of the wells.

Surveys of completed or partially completed wells are made in cased or open hole by oriented or gyroscopic methods or, when it is desired to survey only the uncased portion of the hole, by magnetic multiple shot instruments. The oriented methods employ an instrument run into the well on drill pipe, tubing or rods and the rotation of this string as it is lowered into the well is accurately measured or the string returned to its original alignment as each stand is run in. The gyroscopic method employs an instrument run into cased hole on a wire line and into open hole on the end of a string of drill pipe or tubing. All the different types of instruments run into the hole for making the records take the readings automatically at predetermined intervals and make the complete survey in one round trip. Any electric current necessary for operation is supplied by dry-cell batteries and timing is provided by a clock or watch. The records are made on moving film controlled in its movement by the clock.

The first method of oriented surveying ever employed and which is now widely used with improved technique utilizes a

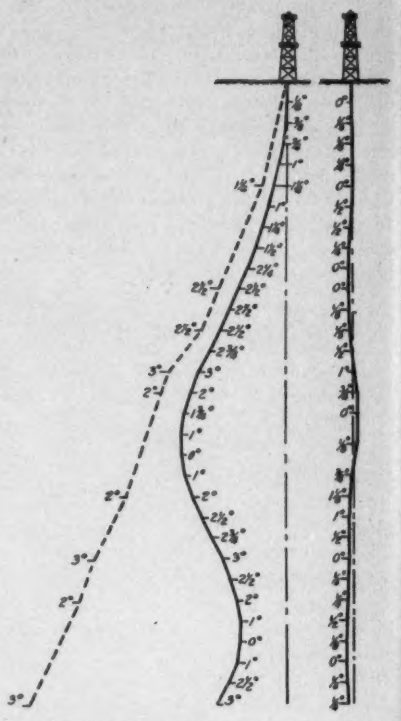


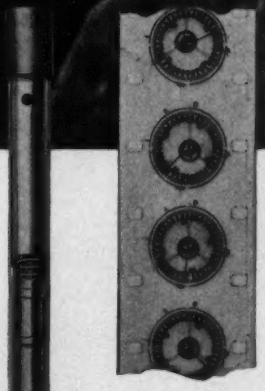
Fig. 2. Broken lines show plot of well made cumulatively from inclination readings taken to keep hole within maximum limits. Solid lines show actual course of well when surveyed.

Fig. 3, right, showing the utilization of small angles for halting inclination trends in controlled vertical drilling.

transit clamped on the pipe at the bottom of the first stand and a telescope clamped at the top. A base line is first established and its azimuth determined. A target set on this line at some distance provides a point on which successive reference sights can be made. The survey instrument attached to the first stand of pipe is aligned by means of the transit with azimuth line and the upper telescope is sighted on the target. The transit and telescope are each fitted with a Morse taper pin and the clamps with Morse taper sockets. When the stand is lowered into the hole, the transit and clamp are first removed from the lower end of the pipe and the derrick telescope taken from its clamp. When the upper clamp reaches position just above the hole, the transit at zero reading is set in the Morse socket and then turned to sight on the target to measure the angle of rotation made by the pipe while the stand was being lowered. The upper clamp is put on the top of the new stand and the derrick telescope set on the reference line. The process is repeated until end of the survey has been reached. The actual position of the in-

where accuracy is vital...

Rely on LANE-WELLS *Surveys*



Lane-Wells Multiple Shot Surveys record inclination and direction of either cased or open hole

Lane-Wells Single Shot readings can be taken during drilling, either on drill pipe or on sand line.

(LEFT) Lane-Wells Single Shot Photo-Record Magnetic Survey Instrument is rented to operators in the United States and Canada and sold for export use.

Accurate file records are a vital part of any system of well control. Few engineers would attempt to plan a remedial program without a complete chart of the course of a well from the surface to bottom.

Lane-Wells Surveys—Magnetic, Oriented or compiled from Single Shot readings taken during drilling—provide the operator with accurate records vital to the formation of an effective control program. A Lane-Wells engineer will be glad to explain how you can profitably use Surveys in the development of your plan of well control.

You'll find it pays to call Lane-Wells.

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The knuckle joint, while not widely used in California is here shown about to be run into a well being directionally drilled.

strument in the hole is thus known for each reading taken and true azimuth as well as inclination is determined from the instrument recording to furnish data for plotting the well.

To orient with the projected vertical plane method of orientation, a base line or azimuth is first established with a fixed point as a marker set on the derrick floor. After the instrument attached to the bottom of the first stand of pipe is aligned with the marker, an adjustable clamp and sighting bar are placed just above it and the bar lined up with the azimuth line. Another adjustable clamp with telescope is placed at the top of the stand of pipe and this clamp is aligned with the sighting bar. After the lower clamp and aligning bar have been removed the stand is lowered into the hole. The sighting bar is then placed into the clamp which has traveled down with the pipe to just above the hole and, after the next stand has been made up, the pipe is turned so that the sighting bar lines up with the azimuth line and the instrument down the hole returned to its original position before the reading for direction and inclination is taken. The upper clamp is placed on top of this stand and the process repeated. An "autophoto" device is generally used for making a continuous survey of the well. This allows the pipe to turn and by recording photographically the position of the projected vertical plane at each stand, eliminates the necessity for turning the pipe back to alignment with the original azimuth line.

With the gyroscopic method a gyroscope in the instrument maintains a fixed azimuth which is established at the beginning of the operation. A box level gauge measures the inclination when the survey is made in directionally drilled wells but a plumb bob is used for vertical wells and for wells with inclinations up to 20°.

Intermittent photographic records show the vertical angle, direction with reference to the fixed azimuth and the image of the clock. This clock is synchronized with a clock at the surface so as to identify the time of the exposure and thus determine the depth at which the reading was taken.

When surveys are made of open hole a multiple-shot magnetic instrument is generally employed. The instruments used for this purpose depend on magnetic compasses for indicating direction and the readings taken automatically at predetermined intervals record the direction and inclination. The readings are photographed on moving film controlled by a clock and current is furnished by dry-cell batteries. The instrument is run on a wire line or sand line and is faster than the oriented survey. When a sand line is not available at the well the instrument is run in and out of the hole by a hoist mounted on a truck which is driven to the well. If it is desired to use the magnetic multiple-shot for surveying a hole that is cased at the top, the instrument can be run in on pipe and the direction secured by orientation through the cased section, the magnetic readings there photographed being disregarded.

With the almost universal use of electrical logging it has frequently been found advantageous to run the multiple-shot

This multiple shot survey instrument about to be run into the hole after taking an electric log utilizes an electrical cable by means of which control at the surface is secured for exposure and film movement.

magnetic survey instrument with the same equipment as that used for the electrical logging service. The logging equipment is pulled out and the survey instrument attached to the electrode then run in, the survey readings being taken on the way out. One type of magnetic multiple-shot instrument used for this purpose is connected by an electric cable to the surface and from there the exposure and film movement is controlled. By combining the electrical logging and survey service both time and money are saved since the surface equipment for doing the job is already set up, rig time loss is reduced and the necessary expense of a separate trip for the survey is eliminated.

The progressive survey is another means of obtaining a complete survey of the hole. The single-shot magnetic instrument is used for this purpose and furnishes readings of both direction and inclination in open hole at the points to which the instrument is run during drilling. When the single-shot instrument is used consistently at regular intervals of approximately 100 feet the course of the well can be plotted as it progresses and upon completion the entire hole will have been surveyed.

The single-shot instrument is sometimes used with the primary objective of checking the deviation of the hole and keeping it within certain maximum limits of inclination as established before the well is started. This is not the method followed by a number of companies in California as described below under "controlled vertical drilling" but is widely used where maximum limits of inclination are established. The importance of the directional reading as well as the measurement of the inclination is shown by Fig. 2 since mere records of inclinations plotted cumulatively will give the erroneous picture of the hole extending far beyond where it actually traveled. Single-shot readings will sometimes have to be taken more frequently than at predetermined intervals if the hole is showing a trend toward exceeding the inclination limit; but the more frequent the readings the more accurate will be the survey plat of the completed well since the increased number of readings will be at precarious points where they will give necessary data for plotting the course. When readings are taken at great and irregular intervals as may be the case when the hole is checked only when the drill string is pulled out of the well, the data for plotting a true course is not available and the well cannot be considered as actually being surveyed.

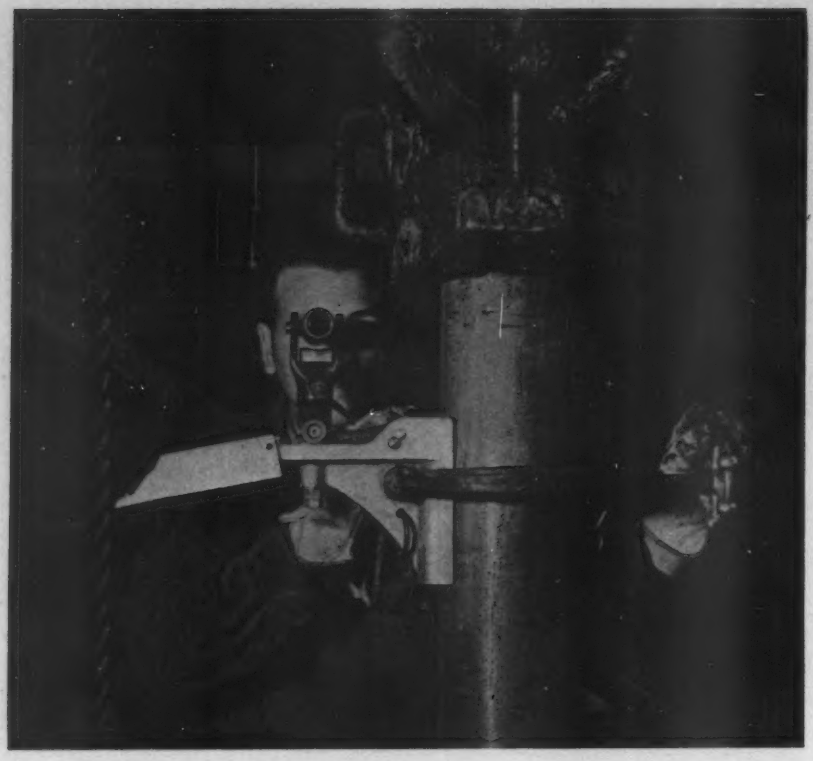
Control of weight carried on the bit and of rotating speed is usually effective in bringing the hole back from a high inclination as disclosed by the single-shot reading. In some cases directional drilling methods may have to be employed for the purpose but since the angle and direction are both given by the single-shot readings a whip stock or knuckle joint can immediately be oriented into the hole as when doing controlled directional drilling. The importance of the weight indicator and tachometer for control of drilling is evident and the combination instruments indicating weight on the bit and rotating speed together with pump pressure and torque are widely used in drilling California wells.

The magnetic single-shot survey instruments now being widely employed provide simultaneous, photographic readings of direction and inclination on circular discs. The time of exposure is controlled by a watch and the current for light is furnished by dry-cell batteries. The direction is measured by a magnetic compass and the inclination by a plumb bob arrangement that differs with the various types. The large or regular size instrument is run in and out of the well on sand line or wire line and when a sand line is not available is handled by a hoist mounted on a truck driven to the location. When desired it can be used on a string of drill pipe or tubing.

The larger size single-shot instruments are run into open hole after the drill string has been pulled out. When the bit drills a great distance of hole before being pulled, the intervals between readings will naturally be great. Small size single-shot instruments which are run inside the drill string are available, however, and allow for taking readings of direction and inclination at more frequent intervals if the string is provided with retractable coring

Fig. 4. Under certain conditions a directionally drilled well is kept within an imaginary cylinder of 25 ft. radius throughout its entire course.

Stabbing upper joint of protective casing over assembled Surwel Unit preparatory to making a gyroscopic continuous directional survey.



Sighting on the target with the telescope at the top of a stand when making an oriented survey.

equipment. These small single-shots extend beyond the bit and into the open hole below in order to eliminate the magnetic influence of metal on the compass. Their operation is similar to the larger size instruments but the records are naturally made on much smaller discs.

Controlled Vertical Drilling

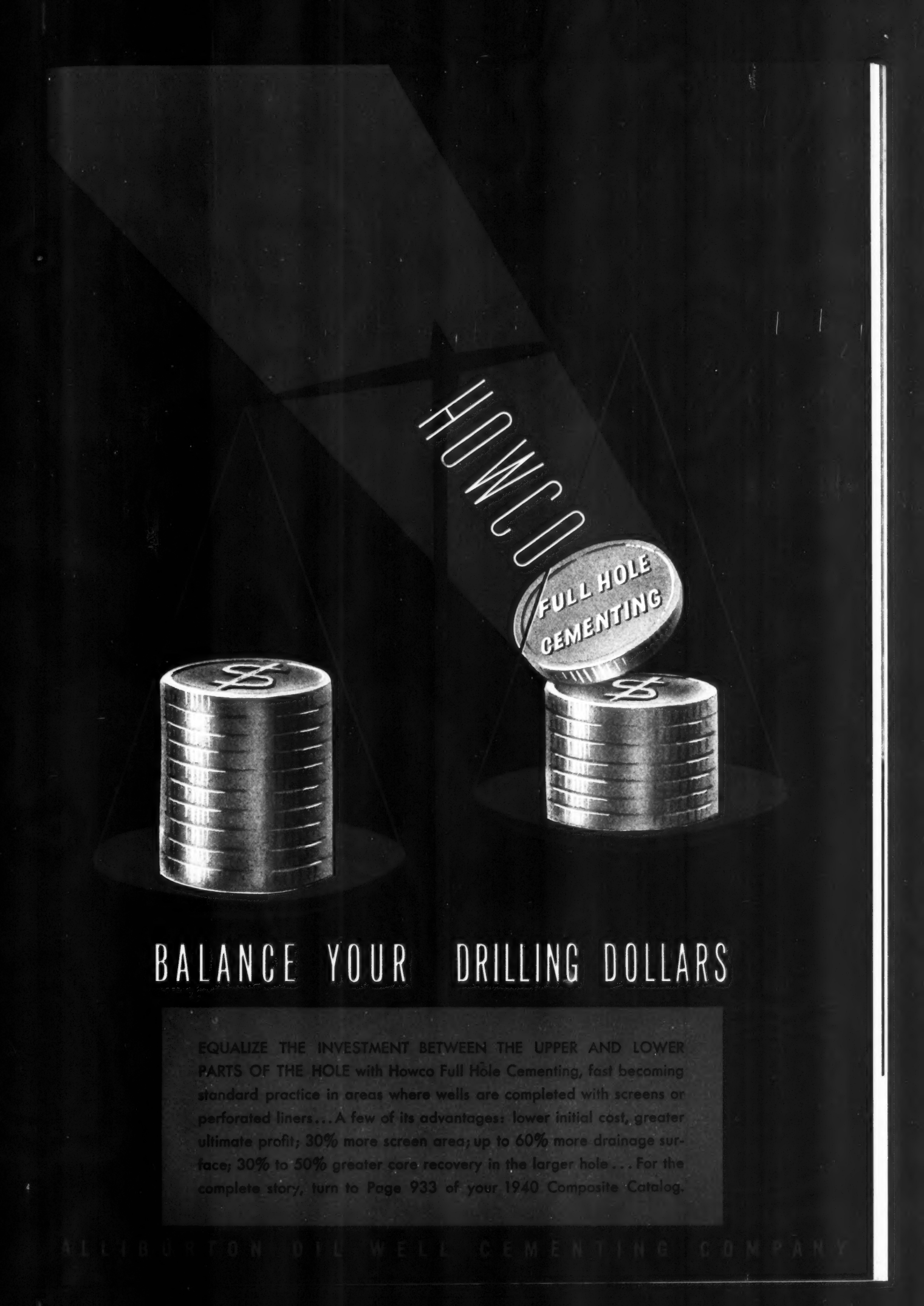
The expression "controlled vertical drilling" as here used describes a method being followed by a number of companies in California for drilling wells as nearly vertical as possible. No allowable inclination is established for the wells since inclination readings are taken at frequent intervals and corrective measures are used to bring the hole back to vertical as soon as a directional trend is indicated. The inclination recorder being employed reads the inclination only and reliance is placed on its accuracy to measure a small fraction of a degree. The angle is recorded on a disc by a small perforation made by a needle. Since angles are kept at such small values they involve no appreciable horizontal deflection and any sight deflections that do occur are cancelled by compensating deflections or eliminated by action of the drill pipe when rotating or being run in and out of the hole. (See Fig. 3.)

The inclination readings are started within the first 100 feet of the surface and continued at intervals of not more than fifty feet from there to the top of the productive zone. The instrument is run inside the drill pipe, either on a wire line or dropped as a go-devil. Some operators take a reading when connections are broken for adding each single of pipe and use the wire line until hard digging prevents the making of more than forty or fifty feet before pulling out. The go-devil type is then frequently employed. The go-devil type is also used for additional readings just before the drill string is pulled, even when a reading with wire line has been made just a few feet above.

The main factors considered in controlled vertical drilling are the tendencies of the drill string to seek the vertical when in tension and to flex under compression. Some operators therefore use drill collars of length and size that will provide all the weight carried on the bit and leave the entire string of smaller, more flexible, drill pipe above in tension at all times. Others are now using a short drill collar with one reamer placed between the bit and collar and another at the top of the drill collar, the reamers serving as stabilizers and helping to keep the section of the string just above the bit from flexing.

When the proper combination of weight and speed is applied to make the bit cut each succeeding formation efficiently while keeping the drill stem in tension, the hole will be drilled within very close limits of a vertical line. An accurate weight indicator and a tachometer will provide for this control and when the hole is checked at frequent intervals the weight and speed can be adjusted to the varying formations. Any slight tendency of the hole to deviate can also be halted while the angle is small. At small angles

The Electrolog equipment is here being used to make a magnetic multiple shot survey in open hole while the electrical logging film is being developed.



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HALLIBURTON OIL WELL CEMENTING COMPANY

Starting an inclination recorder into the drill pipe on wire line to take a reading for controlled vertical drilling before adding a joint to the drill string.

the natural plumb-bob tendency of the drill string when in tension and rotated with lightened weight will straighten the hole. With the angle thus broken and a directional trend prevented the full amount of weight and speed for efficient cutting can again be applied. This process is repeated and it is claimed by several operators that by following this procedure the most effective drilling weight and speed are maintained over the maximum distance of hole drilled.

Small intervals between readings are necessary for this method of controlled vertical drilling for various reasons. By ascertaining a tendency to drift before the angle becomes large the hole can easily be straightened without losing too much time and distance in bringing it back. Two or more readings must, moreover, be compared to determine whether the inclination is increasing or decreasing since one reading alone will not show the inclination trend in relation to what it may have been some distance up the well. If closely spaced readings show a change in the angle, the weight and rotating speed can be changed to meet the conditions.

Drill pipe singles being used in California vary from 30 to 45 feet in length so readings taken when each single is added will also vary. Some companies run the inclination recorder at specified distance intervals which are seldom more than 50 feet. This practically eliminates the chance of passing a critical angle which has been found to vary from less than one degree to one and one-half degrees, depending on size of hole, size of drill collar, diameter of drill pipe, size and position of reamers when they are used as stabilizers and on other downhole conditions.

Considerable importance is placed on starting the readings of inclination at the surface since the surface string does much toward guiding the remainder of the hole. With any appreciable inclination in this string, excessive vibration and drill pipe or casing wear may occur as greater tension is placed on the drill string with increased depth of drilling.

Limited Inclination Drilling

Some operators consider the hole to be straight when inclinations are limited to 3 degrees, or even 5 degrees, and establish such limiting angles which must not be exceeded during drilling. The method used for drilling wells under these restrictions is sometimes called "slope testing."

As discussed under "Underground Surveys," the magnetic single-shot instrument is widely used for checking the inclination of a well during drilling and when the readings are taken at frequent enough intervals a complete survey of the hole can be made since allowable maximum angles of inclination established up to 3 degrees or 5 degrees permit definite directional measurements. Under certain conditions, however, some operators prefer to keep their wells within prescribed limits by merely checking the inclination. The acid bottle was first introduced for this purpose but more accurate, permanent records are now usually made with instruments that give the inclination only.

These instruments are furnished to run in drill pipe or open hole, on wire line or dropped as go-devils and will take the reading in cased or open hole since magnetic influence does not have to be considered. One kind of instrument is of the self-checking fluid type which uses a harmless dye for recording the inclination on a paper sheet. The other types used furnish a disc on which the inclination is recorded. The record on the disc is made either photographically in a manner similar to the single-shot instruments or by a needle which perforates the disc.

Controlled Directional Drilling

By controlled directional drilling is meant the technique followed in drilling a hole to some predetermined point below ground which is horizontally distant from the surface location; or in diverting a hole from some underground point into another direction or to a different point. Directional drilling is therefore applied to new wells, sometimes called "slant holes," located at one place on the surface and ending up at some definite point not vertically below the derrick; to correcting the course of a well that has drifted beyond desired limits; or to recompletion or repair of old wells for production purposes. Controlled directional drilling has probably been used to a greater extent in California than in any other oil producing area and has been the means of tapping productive zones at points which could not otherwise have been reached—or could have been reached only at great expense.

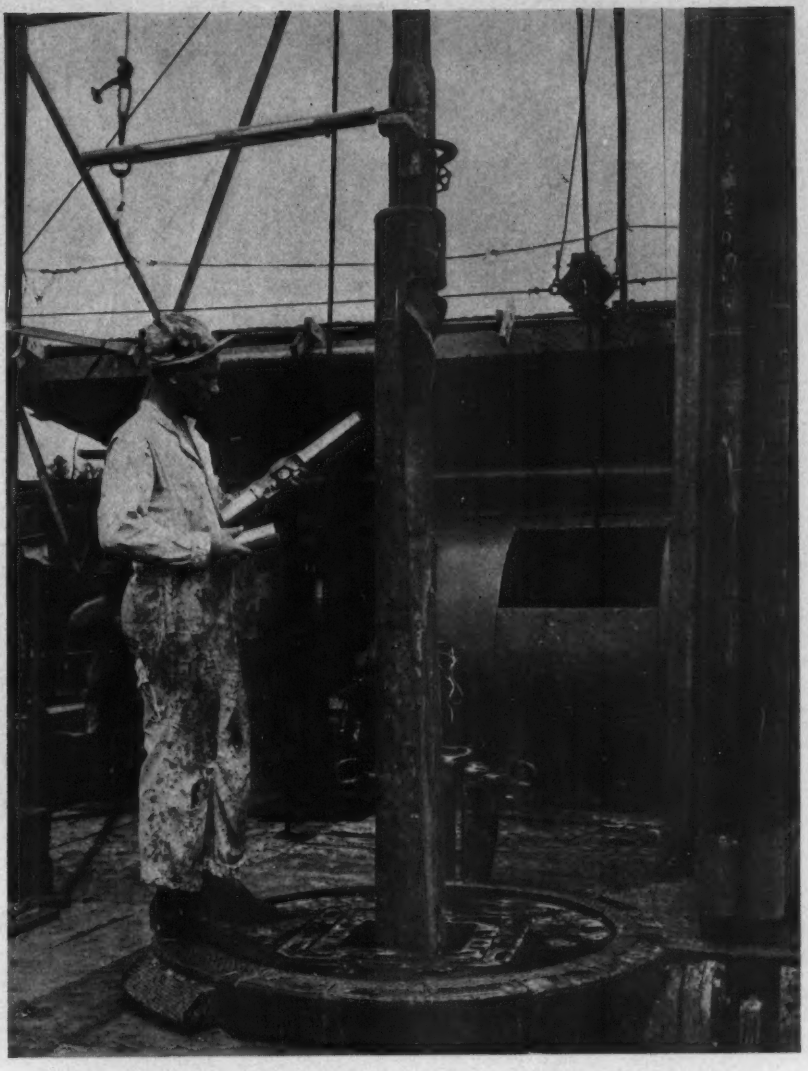
Drilling to structures offshore along the Pacific Ocean such as those found at Elwood, Rincon and Huntington Beach has been simplified by directional drilling. In the Coastal fields considerable pier expense has been eliminated by drilling as many as three locations from the same approximate point. This has been done by spacing the well heads within a few feet of each other and not only eliminating the necessity for extensive pier construction but also utilizing one derrick set-up and skidding the rig the required amount for each hole. At Huntington Beach where off shore locations of any kind can not be made, it has been possible to reach the productive zone under the ocean by directional drilling. In the Long Beach Harbor District wells have been completed under channels which naturally could not be blocked with derricks and rigs.

Other inaccessible locations that have been reached by directional drilling have been under buildings such as the Ford Plant at Wilmington or the Edison Plant in the Harbor area and in hilly mountainous areas like, and sometimes worse than, those found at Ventura.

It is doubtful if the complete scope of directional drilling has yet been utilized even considering its use in salt dome drilling in other states and countries or its drilling of relief holes that have been the means of controlling cratered wells. In redrilling or repair work many wells have been recompleted in the same sand for greatly increased production or have been carried down to deeper zones by directional drilling operations when subsurface conditions have prevented more conventional deepening work.

Directional drilling technique depends on the data furnished by magnetic single-shot readings. By means of these readings the hole is started off in the desired direction and inclination and is kept along its predetermined course. Both the regular size single-shot instrument and the small size run inside the drill pipe and utilizing retractable coring equipment are used. Direction is changed by means of removable whipstocks or knuckle joints although the general practice in California at the present time is to use the removable whipstock in nearly all directional drilling operations.

Both the whipstock and knuckle joint are oriented into the hole with the projected vertical plane method as described under "Underground Surveys." In using this method for orienting in the whipstock, the tool is set in the table and turned to the azimuth required at the point where the change in direction is tc take place. By turning the drill pipe back to this alignment when each stand is run in, the whipstock will be set in its proper direction when it reaches bottom. Special bits are generally used for directional drilling and include many types, including rock bits that have been found necessary for cutting hard formations. Since no dog-legs should result from the directional drilling operations the hole is curved horizontally as well as vertically when any changes in direction and inclination are made.



This whipstock with sighting bar in place above is ready to be oriented into a well for directional drilling deflection.

In most directional drilling operations greatest attention is usually paid to completing the well as close as possible to the predetermined point and in making the changes in direction and inclination so smooth that trouble in running casing and wear of rods and tubing after the well goes on the pump will be reduced to a minimum. This requires little attention as to the general course of the hole. However, where close spacing or a number of vertical and slant holes have been drilled, such as at Huntington Beach and Long Beach, it is sometimes specified that the entire course of a well shall not pass out of an imaginary cylinder of 25-ft. radius which is established before the well is started. This is illustrated by Fig. 4.

Directional drilling requires due consideration of many factors. Among these are the condition of the hole, the limitation of direction and angle, the footage to be drilled, the formations that have to be passed through, the structure, the drilling equipment and the sizes of hole, bits and drill pipe. The average approach to the angle desired is probably 3 degrees per 100 feet until the angle is reached.

With the direction and angle known it can be determined at what depth to start deflecting. In an 8000-ft. well that is to bottom at a point 300 feet horizontally from the surface location it will usually

(Continued on Page 36)

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LOS ANGELES BAKERSFIELD

Field Development

Los Angeles Basin

Havenstrite Recompletes Del Valle Discovery Well

Lincoln No. 1, R. E. Havenstrite, Operator's discovery well of the new Del Valle field, was recompleted Oct. 17 as a black oil producer after changing the mechanical condition of the hole to eliminate the large volume of high pressure gas present in the initial test.

For the first trial casing was cemented at 6653 ft. and 335 ft. of 5-in. liner including 220 ft. of 100 mesh perforations was landed on bottom at 6954 ft. Swabbed in through tubing, gas production exceeded 10,000,000 cu. ft. while the oil yield, largely high gravity condensate, varied from 400 to 1200 bbls. according to bean size. At no time was the well wide open.

Following the dictates of good production practice, the flow was killed and the liner recovered to 6802 ft. where a blank liner of drillable material was cemented and gun perforated from 6700 ft. to 6740 ft. Tubing was then run to 6850 ft. and a packer set at 6750 ft. in the blank section of the liner between the gas and oil zones. An Otis Sleeve was included in the tubing string immediately above the packer. Initial recompletion gauges were 960 bbls. a day of 33 gravity oil cutting 2.0% and 300,000 cu. ft. of gas. This rate was established through the tubing from the dark oil zone in the lower portion of the hole and was through a 16/64-in. bean under 300 lbs. flow pressure. At the same time a short test of the gas zone was made by opening the casing bean to 24/64-in. The resulting flow was estimated at over 5,000,000 cu. ft. The normal 2400-lb. casing pressure dropped to 1950 lbs. during the trial.

The mechanical set-up in the well is similar to that successfully employed in the Montebello and Coalinga Northeast fields where high pressure gas sands lie just above the oil zones. Its advantages are that the adjustable sleeve in the tubing set above the packer and opposite the gas horizon may be regulated to "gas lift" the oil from the lower zone and to adjust the gas-oil ratio at will. The method permits of the greatest possible oil recovery with strict conservation and utilization of gas.

The Del Valle field is notable in that it is one of the very few discovered by independent operators. Aside from its neighbor to the south, Newhall-Potrero, and the Coalinga Eocene Pool, Del Valle is the only major discovery in recent years to be credited solely to the interpretation of surface geology. These have definitely shown that this method of finding new fields is not passé and have reawakened operators to the possibilities of the Newhall-Castaic area where many wildcats are expected to be drilled within the next few months.

The Havenstrite organization will develop the field in a routine manner employing two strings of tools. Prelimin-

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Athens	Rankin & Williams	1	7, 3-13	6520	Rigged—Idle
Castaic	Colter, R. T., Explor.	1	8, 4-17	1338	Idle
	Havenstrite, R. E., Lincoln	1	16, 4-17	6954	Producing
	Havenstrite, R. E., Lincoln	2	16, 4-17		Rig
	Pedro Pet. Co., Oates	1	24, 5-17	1620	Drilling
	Worland Oil Co., Jenkins-Owens	1	18, 5-16	2790	Idle
Dominguez, West	Wood-Mellon Oil Co., Wood	1	31, 3-13	7498	Idle
La Habra	Fullerton Oil Co.	6	25, 2-11	300	Drilling
	Union Oil Co., Sansinena	12	31, 3-10	5698	Abandoned
Malibu	Sovereign Oil Corp., Sovereign-Marblehead	1	7, 2-18	3000	Drilling
Newhall	Canyon Oil Co., Sanborn	1	6, 3-16		Rig
	Creighton Hammon Synd., C. H.	1	17, 3-16	990	Idle
	Irene Oil Co., Kraft	1	31, 4-15		Rig
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	6580	Idle
San Fernando	Casa Grande Oil Co., Lopez-Lundy	1	1, 2-15	3785	Idle
	Parry, Geo. G., Moynier-Parry	1	6, 2-14	4216	Abandoned
West Whittier	Cal. Pico Oil Co., Beach	1	7, 2-11	7086	Idle
	Orange County				
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	5625	Cleaning out
	San Bernardino County				
Carbon Canyon	Earp, H. R., Kraemer-Backs	1	34, 2-8	900	Drilling
	Kipp, George, Inc., Bannon	1	32, 2-8	869	Testing

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Merced	Don Pedro Oil Co.	1	9, 6s-9e	1610	Idle
Monterey	Loma Grande Oil Co., Corey	1	23, 24s-10e	1581	Idle
	Priest Valley Pet. Co., Greve	1	22, 20s-12e	2885	Idle
Solano	Standard Oil Co., McCormack	1	31, 4n-3e	4550	Drilling
San Mateo	Ra-Lite Petroleum, Inc., Bell	5	16, 7s-4w	1175	Cleaning out
Yolo	Standard Oil Co., Tippets	2-1	9, 12n-3w	2000	Drilling
Yuba	Wright, L. G., Cox	1	18, 14n-5e	1800	Drilling

ary work is already under way for No. 2 on the Lincoln property which will be 660 ft. south and 660 ft. east of No. 1.

The structure is believed to be an anticline plunging to the east and closed by a fault on the west. The productive sands are in the Modelo portion of the Upper Miocene and are similar to those producing in the Newhall-Potrero field discovered by Barnsdall Oil Co. three years ago.

Deep Hill Well Delayed by Fish

Union Oil Co.'s Long Beach Community No. 19, offset to Dormax Oil Co.'s 10,411 ft. No. 1, was delayed at 4994 ft. by the drill pipe becoming stuck after circulation was lost at approximately 4970 ft.

In the cemetery area, R. Allen Brown is finishing the Moulton well and J. R. Losch has taken over the Fred Higgins project. Both are directional jobs. Apex Petroleum Co. is redrilling its No. 13-A at the northeast corner of Willow and Orange while Hilldon Oil Co. is completing Food Control No. 4 in the northwest extension of the field.

Northwest Activity Leading Wilmington

Most active portion of the Wilmington field at present is the northwest area where C. M. Morse, Fuller Petroleum Co. and others have completed good wells. Scattered new wells about the field have been brought in for satisfactory yields, the largest being those in the Union Pacific sector where all zones are prolific.

North of State St. and east of Figueroa St., American Oil Co., is preparing to drill an interesting well between the Torrance and Wilmington fields.

Universal Completes Deep Rosecrans Well

With hole deepened to approximately 8275 ft., Universal Consolidated Oil Co. recompleted Trust No. 14 at Rosecrans flowing by heads at an estimated daily rate of 250 bbls. of 31 gravity clean oil. Located at the northwest corner of Figueroa St. and Rosecrans Blvd., the well is the deepest in this section of the field and is good enough to encourage the deepening of others as O'Dea zone production declines. The liner was cemented through perforations at about 8050 ft. leaving only the lower 225 ft. of hole open.

In the active area at the intersection of Main St. and Redondo Beach Blvd., St. Anthony Oil Corp. is preparing to bring in Gordon No. 5 and recomplete No. 2 while No. 6 is drilling near the 7000 ft. level. Thos. Kelly & Sons, Inc., McMillen No. 4 is scheduled for early completion.

East Coyote Wells Exceed Expectations

With production exceeding expectations, two fair wells were completed recently in the "Hot Spot" of East Coyote. First to go on the pump was East Coyote Oil Co.'s B-1 which, bottomed at 4248 ft. and gun perforated below 4227 ft., came in for 150 bbls. and is now doing about 130 bbls. of 23.5 gravity oil cutting 5.0%.

Shortly following was Harrison M. Tucker's No. 1 on the Wright lease which finished at 4210 ft. for 135 bbls. Neither the electric log nor the cores looked too encouraging in either well and the relatively good yields came as a surprise.

Due for early production trials are Metro Petroleum Co.'s Robertson No. 10 which has set casing over the Lemke zone and Barth Oil Producers Queyrel No. 1 which will attempt to complete in the 3200 ft. Anaheim zone.

Deep Dominguez Test Cores Below 8th Zone

Withholding all information except depth, Union Oil Co. is coring at 8150 ft., well below the Eighth Callender zone, in Callender No. 79 which was announced as a deep test of the west fault block in the Dominguez field. Probably responsible for the rumors that the well will explore to great depth is the fact that the company is using a 178 ft. derrick, the first to be erected in the Los Angeles Basin, while a standard rig is being used on Long Beach Community No. 19 which must go to 10,500 ft. to fulfill offset requirements.

In the extreme westerly portion of the field, Union brought in Austin No. 5 flowing 800 bbls. a day after cementing 5½ in. casing on bottom at 7515 ft. and gun perforating the Seventh and Eighth zones.

Huntington Beach Activity Reviewed

Activity at Huntington Beach of late has been confined to opposite ends of the Old Field and to the tideland wells on the ocean front. At the easterly extremity of production, B.M.W. Oil Co. is preparing to clean out and deepen the

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old Standard Oil Co. Farnsworth No. 3 which was redrilled six months ago by Desert Glow Oil Co. A step to the west, H.R.O. Oil Co. is redrilling its townlot outpost to recomplete in the 2100 ft. Tar Zone. The well was never a satisfactory producer because of sand trouble and it is planned now to install a gravel wrapped liner.

In the old easterly townlot section, Richfield Oil Corp. recompleted Johnson No. 4 at 2925 ft., with a pre-pack liner, pumping 50 bbls. net oil. Gross production runs about 100 bbls.

The Termo Co. is preparing to drill Fee No. 3, a State tideland well, while Southwest Exploration Co. is completing No. 32 and is getting ready for No. 33.

On its Bolsa lease in the far west end of the field, Signal Oil & Gas Co. finished three more wells with production ranging from 100 to 450 bbls. a day and is drilling two more.

Turf Oil Starts 2nd Potrero Well

In hopes of duplicating the 500 bbl. production obtained by Tide Water Associated Oil Co. in Cypress No. 3, Turf Oil Co. is starting a second well on the grounds of the Hollywood Turf Club at Potrero. Tide Water's project was finished in the Willis zone at 5755 ft. and produces 45 gravity oil with a large amount of gas.

Beloil Corp. completed a directional job with production estimated at 50 bbls. of light oil and 4,000,000 cu. ft. of gas.

Malibu Wildcat Drills Hard Stuff

Sovereign Oil Corp.'s Malibu No. 1, located on Point Dume west of Malibu Beach, is reported drilling in a hard conglomerate containing some crystaline rock near the 3000 ft. level. The same formation is said to have been encountered in an old well in the vicinity.

New Producers Due In Bartholomae Area

Scheduled to complete in the near future are Standard Oil Co.'s Coyote No. 2-14 and Bartholomae Oil Corp.'s Stern No. 3-A, both in the extreme westerly section of the East Coyote field. At this writing, both are bottomed at 6880 ft., and are testing for production.

Standard has run formation tests on nearly every foot of the deep zone in No. 2-14 and indications are that a fine well will be obtained. Being equally well located, the Bartholomae project is expected to do as well.

Drilling on adjoining property, Union Oil Co. is below 5600 ft. in Toussau No. 2.

Inglewood Test Standing Idle

After several attempts to get by the fish ended in failure, Federal Oil Co. suspended operations in Smith No. 1 at the north end of the Inglewood field. While drilling at 7860 ft., the bit entered a softer formation and good oil and gas showings appeared on the ditch. A core was taken to 7885 ft. but the drill pipe "froze" and had to be shot off at the top of the drill collars. Efforts to wash over and pull the fish were unavailing as were two attempts

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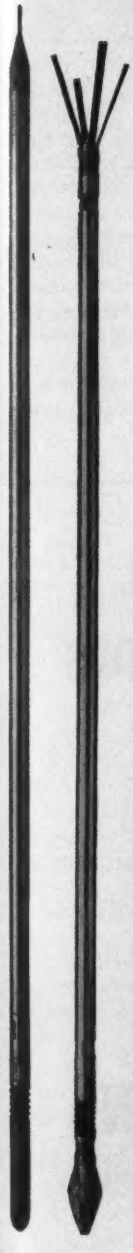
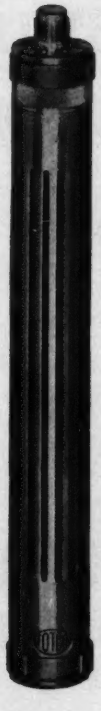


The Totco recording instrument (above right) is encased in a fluid tight go-devil while being run through the drill pipe. Two go-devils (A) for running on measuring line, and (B) for drop-in use, are shown.

HERE is a chart of the course of a typical controlled vertical well. Note that the entire course of the well is within very close limits of a vertical line, and that the angles are low.

Controlled vertical drilling is the practice of USING the information supplied by accurate vertical angle records, taken at close intervals, to direct the course of the bit *straight down*. This results in greater drilling speed because, when the hole is vertical, every formation can be drilled with the most efficient combination of drilling weight and rotation speed for fastest penetration. Mechanical trouble and lost time are avoided; operating costs are reduced; the well is a better well during all of its producing life. It is the *modern* method of drilling—and any drilling crew can successfully practice controlled vertical drilling methods with the regular drilling equipment.



HOW INCLINATION RECORDS ARE USED TO CONFINE THE COURSE OF THE HOLE TO VERTICAL

A single record taken at any point and considered alone can only serve as a slope-test. In order to practise controlled vertical drilling the driller must be informed as to whether the angle of the hole is increasing, decreasing, or remaining the same. This information is gained by considering two or more records taken at close intervals (50 to 100 feet apart is recommended). If these records show an increasing angle, he immediately changes the drilling weight and speed to reduce the angle while it is small. The drill string acts as a plumb-bob, and tends to return to vertical when it is in tension; the bit, therefore, cuts away toward the *low* side of the hole when drilling weight is reduced, returning the hole toward vertical.

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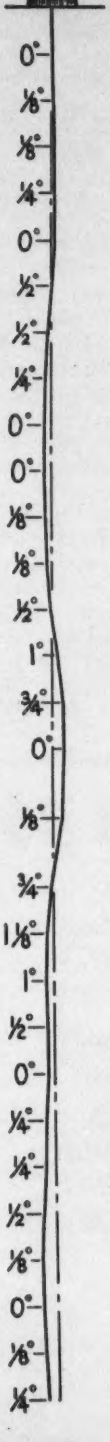
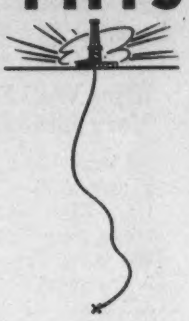
Describes controlled vertical drilling methods, gives complete description of Totco Recorders, and illustrated operating instructions. Give Company name and position, please.



NOT THIS

This is a controlled directional well. Readings of both vertical angles and direction are essential, and special drilling tools, deflecting equipment, and highly skilled supervision are required.

NOT THIS



A crooked well costs more and requires more drilling time than a controlled vertical well. Slope-testing, the practice of taking vertical angle readings just to determine whether or not the contract limit is exceeded, is NOT controlled vertical drilling.

WHY YOU NEED THE TOTCO RECORDER FOR CONTROLLED VERTICAL DRILLING

Any Recorder must meet these requirements to be fitted for use in Controlled Vertical Drilling: The record must be ACCURATE, readily readable to ⅛ of one degree or less, and immediately available to the driller. The instrument must be easy for a member of the drilling crew to handle with uniformly good results. Timing must be so accurately controlled that a record can be taken with a stop on bottom of 45 seconds or less. The instrument must maintain laboratory accuracy indefinitely, have an operating efficiency of 98 or more perfect runs out of every 100, and it must be adaptable to all methods of running. The Totco Recorder meets these requirements because it was developed especially for Controlled Vertical Drilling.

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to sidetrack. Plans now are to redrill from 7600 ft.

Kettleman & Inglewood Corp. and Standard Oil Co. are going ahead with preparations to drill four wells to the developed zones in the center of the field.

Kipp Well Finds Very Little Fluid

Disappointing to those who hoped for a new shallow field were reports that Geo. Kipp, Inc.'s Bannon No. 1 obtained very little fluid in a test from 600 ft. to bottom at 869 ft. The well is located in the hills west of Chino and south of the Carbon Canyon road where E. F. Stella has drilled several holes in the past few years, one of which produced a small amount of oil.

L. A. Nomads Told About Patagonia and Antartica

Charles Gill Morgan, a member of the chapter who has conducted a great deal of geophysical work in South America, was the principal speaker at the October meeting of the Los Angeles Chapter of Nomads. He described recent operations in Patagonia, northern Argentina and Brazil. His talk was illustrated with motion pictures. Mr. Morgan, moreover, was a member of the second Byrd Expedition to Little America in the Antarctic and he then gave a most interesting talk on the work of the Expedition. This was accompanied by slides which depicted the living conditions during the time Admiral Byrd and his party were in Little America. Mr. Morgan kindly answered all questions asked by the Nomads present who seemed reluctant to let him get away. The meeting lasted until nearly midnight.

Due to absence from the city of the president and vice-president, the business meeting was conducted by Bill Bettis and the dinner session was presided over by Earl Rees. Elmer Decker, national president of the Nomads, proposed that the chapter conduct classes in Spanish for the members since it is widely felt that a knowledge of and ability to speak that language will do much toward increasing the friendly relations with Latin Americans whom the Nomads contact in their trips to South America. He emphasized that there will be an ever-increasing demand for contact with Spanish-speaking people in the selling of oil equipment and that everyone traveling in South American countries should be able to speak the language. A committee was appointed to take this matter under consideration and make a report at the next meeting.

Among the guests at the Nomads dinner were the following men from foreign fields: R. E. Curran of Burmah Oil Co.; E. A. Kodyen of Papuan Anipiani Petroleum Co., Papua; E. M. Donovan of Burmah Oil Co. at Digboi, Upper Assam; J. A. Thornton of B.P.M. at Curacao; M. H. Bush of Bahrein Petroleum Co.; J. S. Aston of Ultramar, S.A.P.A.; H. J. Cleave of Caribbean Petroleum Co. at Maracaibo; B. E. Ormsby of Texas Co. of Venezuela; and Phillippi Gordon of the Kern Trinidad Oilfields, Ltd.

Mojave Desert Well Suspended At 2942 Ft.

Drilled in the Cantil area, 20 miles northeast of Mojave, Red Rock Co.'s well is idle in red shale at 2942 ft. Bottom 200 ft. of formation was alternate sandstone and red shale containing no showings. Spudded during July of this year, in sec. 13,30-37, the only claims made for the well were gas showings at 1400 ft. and slight oil shows at 1600 ft. Due to inaccessability of the well, little professional scouting was done, and most reports are tendered by returning desert travelers.

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Pure Oil Well Locates East Coalinga Shoreline

First Coalinga-Northeast well adjacent to production to miss the Gatchell sand was Pure Oil Co.'s East Coalinga Subdivision No. 1 in the northeast quarter of the southwest quarter of sec. 30,19-16. Apparently just west of the pinch-out point, seven feet of hard impermeable sand was topped at 8117 ft. which has been tentatively identified as the "EG" normally immediately above the "EGA" or Gatchell sand in the productive area. This development puts a question mark after the company's Schwinn No. 2, one location to the north, which is drilling at 6800 ft.

Pacific Western Oil Corp. & Geo. F. Getty, Inc., obtained their first test of Coalinga gravy in finishing E. Coalinga Community No. 1 flowing at an initial rate of 1165 bbls. a day with the hole open from the top of the sand at 8105 ft. to bottom at 8270 ft. This is the most southerly well in the field and is one more step toward the possible eventual connection with the twin Eocene pool to the south.

Another good sec. 30 completion was credited to Bandini Petroleum Co. when No. 41-30B came in for better than 800 bbls. a day. Located 250 ft. south and 330 ft. west of the north quarter of the section, only the 20 ft. sand interval above bottom at 8293 ft. was taken.

Ih a proved location offsetting the Pacific Western-Getty Goodell No. 1, now coring for the oil sand, Wilshire Annex Oil Co. is preparing to complete No. 52-30B.

Standard Oil Co. is completing No. 77-7B, most northerly well in the field, and has just brought in No. 75-19B as a typically good producer.

Bottomed at 8360 ft. in gray sand and plugged back above the water table to 8240 ft., where 4 holes from 8230-32 ft. are open, Amerada Petroleum Corp.'s S.P.L. No. 1-17B initialed 101 bbls. of clean 26 gravity oil in 6 hours. Last production was gauged at 205 bbls. through a 8/64 in. bean with 109,000 cu. ft. of gas.

Located in the northwest corner of sec. 17,19-16 at the north edge of the Coalinga Northeast field which Amerada discovered, the well was originally finished at 8308 ft., in gray sand topped at 8267 ft. after cementing a 5½ in. string at 8296 ft. First production was from 4 holes at 8170-74 ft., where production was 1680 bbls. through a 35/64 in. bean.

The Gatchell zone here shows a thinning of 36 ft. when compared to No. 26-17, first of Amerada's wells to drill through, near the center of the southwest quarter of the section. A general thinning is indicated by the absence of sands in Tide Water Associated Oil Co.'s recent wildcat, Standard Investment No. 1, in the northwest corner of sec. 6, 19-16.

Present Wildcat Crop Viewed as Unpromising

The present crop of San Joaquin Valley wildcats, generally speaking, is rather an unpromising lot and prospects for new major discoveries before the end of the current year are fading fast. Typical of the group is The Texas Co.'s Everding No. 1 in sec. 24,17-15 which it was hoped would find the long-sought Cantua Creek field. Located close by the company's S. P. No. 1, a small gasser from 9350 ft., the present try is below 9800 ft. and has found nothing yet to warrant a test.

In the Jacalitos Hills six miles west of Kettleman North Dome, Continental Oil Co. has passed the 10,350 ft. mark in Kreyenhagen No. 1 and is unofficially reported to have found the Eocene barren. Location is in sec. 4,22-16.

Though a head of gas is occasionally bled from Jergins Oil Co.'s Cheney Ranch No. 1, sec. 29,14-13 near Mendota, the well is far from a commercial producer and arrangements are being made for a pooling of interests of several operators for the drilling of a new test.

With Seaboard Oil Corp.'s Beer No. 66 near the 8300 ft. level in Cretaceous topped at 7500 ft., hope for deep production near Devils Den has practically disappeared for the time being. Amerada Petroleum Corp. had previously drilled three wells in the same section, 17,26-19, the deepest being carried to about 4300 ft. More success has attended efforts to obtain shallow production north of the old Devils Den field where small wells have been completed by H. C. Trigg and Tide Water Associated Oil Co. In sec. 26,25-18, Raymond D. Herzog is preparing to drill a new well adjoining the old producers.

Kern Line Oil Co.'s well east of the Highway north of the Grapevine, at 7000 ft. looks only so-so although there has been some evidence of gas. To 7500 ft., Richfield Oil Corp.'s Tejon Ranch No. 1, sec. 2,10-19, has reported no showings of importance. Richfield's second Wheeler Ridge deep test has passed 9000 ft. and is still going, apparently headed for the San Emigdio sand found in the first well at 10,700 ft. It is significant that the 8600 ft. Miocene zone from which No. 1 produced for several months was not tested in No. 2.

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Cantua Creek	The Texas Co., Everding	1	24, 17-15	9800	Drilling
Coalinga	Classen, W. J. & Assoc.	1	1, 21-14	850	Drilling
	Lewis, C. H.	1	18, 21-15	2298	Idle
	Tide Water Assoc. Oil Co., Guardian	23	2, 20-15	3731	Pumps water
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13	665	Drilling
Jacalitos	Continental Oil Co., Kreyenhagen	1	4, 22-16	10411	Drilling
Mendota	Jergins Oil Co., Cheney Ranch	1	29, 14-13	9345	Idle
	Kern County				
Belridge—South	DeLanty & Sutton, Trustees	1	28, 28-22	3020	Idle
	Santa Mora Oil Co.	1	10, 28-20	50	Idle
Devils Den	Herzog, R. D., Collins	1	11, 25-18		Rig
	Seaboard Oil Co., Beer	66	17, 26-19	8310	Drilling
	Trigg, H. C.	2	11, 11-11	954	Testing
Edison	Goodrum & Vincent, Inc., S.P.	7	31, 29-30	460	Idle
	O'Reilly, Francis, Edison Land	2	5, 30-29	4103	Testing
	Wood-Callahan, Lubold	1	21, 30-29	2350	Drilling
Grapevine	Kern Line Oil Co.	1	19, 11-19	6915	Drilling
	Richfield Oil Corp., Tejon Ranch	1	2, 10-19	7540	Drilling
Richgrove	Borget, A. J., Kendall	1	16, 25-27	40	Idle
Round Mountain	Spartan Drlg. Co., Hiatt	1	32, 28-29	2085	Idle
Wheeler Ridge	Richfield Oil Corp. KCL	2	28, 11-20	9100	Drilling
	Kings County				
Pyramid Hills	Tide Water Assoc. Oil Co., West Slope	31	20, 24-18	780	Drilling
	Tulare County				
Trico	Union Oil Co., Seymour	1	20, 24-23		Grade

In an attempt to extend the Trico gas field to the northwest, Union Oil Co. is preparing to drill Seymour No. 1 in the center of the northwest quarter of sec. 20,24-23.

Coles Levee Leads In Valley Development

Due to Richfield Oil Corp.'s intensive drilling campaign, Coles Levee is yet the most active field in the entire San Joaquin Valley. With most of the drilling done by contractors, the 9000 ft. wells are finished normally in 60 to 75 days with production ranging from a few hundred barrels to over 2000 bbls. according to location. Only other active operators in the field are Ohio Oil Co. with two strings of tools and Standard Oil Co. with one.

Lytle Finishes Two East Coalinga Wells

Robert S. Lytle, Operator, finished two big producers in the East Coalinga Eocene pool recently, each making 2500 bbls. a day through a restricted orifice. Both were inside locations in sec. 18,-20-16. One of the most interesting wells in the field at present is Lytle's No. 1-20F in the northwest corner of sec. 20,20-16. A formation test indicated the Gatchell sand, topped at 7700 ft., will be productive but care must be exercised here that bottom water be not encountered.

Priest Valley Test Recovered Only H_2O

According to reports received in Los Angeles, a recent production test of Priest Valley Petroleum Co.'s Greve No. 1 recovered only water from the interval 2660-2850 ft. The well is situated on the flank of a recognized anticline in sec. 22,20-12, about 15 miles west of Coalinga.

P. W. Redrills Wasco Outpost

After finding the A-2 sand wet at 13,150 ft., Pacific Western Oil Corp. plugged back Meyer No. 1 at Wasco and is redrilling near the 12,000 ft. level. The well is the most northwesterly to be drilled in California's deepest field. Standard Oil Co.'s newest project is Mushrush No. 6, to be drilled by Bell & Loffland, Inc., who will be the second contractor to assume the staggering job of carrying a well to successful completion below 13,000 ft. Rocky Mountain Drilling Co.'s record here is a monument to the enterprise and skill of present day drilling contractors.

Superior Finishes 2 Rio Bravo Wells

Two big wells were finished by Superior Oil Co. in the Rio Bravo field during the past fortnight, both in the northwesterly section. Highest structurally of the pair was Rudnick No. 4 which encountered the top of the oil sand at 11,140 ft. and completed at 11,380 ft. flowing 1573 bbls. a day of 39.5 gravity clean oil. Curtis No. 1 topped the zone at 11,282 ft. and bottomed at 11,426 ft. Neither well was flowed wide open and both are now beaned back to their allowables.

Wildcat Test of Sacramento Co.

J. L. Milburn, well known oil operator, and Lowell Saunders plan to drill a wildcat some 15 miles southeast of Sacramento in sec. 19,7n-6e. The project will be called Independent Exploration Co. No. 1.

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Quantitative Introduction to Gravity Prospecting, by Frederick Romberg, Geophysical Service, Inc.

Late Miocene and Pliocene Stratigraphy and Paleontology of the Santa Maria District, California, by W. P. Woodring, U.S.G.S., and M. N. Bramlette, U.C.L.A.

Thrust Faulting and Coarse Clastics in Temblor Range, California, by F. S. Hudson, and G. H. White, Shell Oil Co.

Luncheon Meeting—Cocoanut Grove, Ambassador Hotel, 12:30 p.m., Nov. 7, Discussion of Affairs and Plans of Research Committee of A.A.P.G., by A. I. Levorsen, past president of A.A.P.G., Tulsa.

The Estimation by Volumetric Methods of Recoverable Oil and Gas from Sands, by John F. Dodge, U.S.C.; Howard C. Pyle, Union Oil Co., and Everett G. Trostel, Union Oil Co.

The Accumulation of Marine Diatomaceous Sediments, by Richard W. Fleming and M. C. Sargent, The Scripps Institution of Oceanography.

Thursday Evening, November 7, Annual Meeting of the Pacific Section of the Society of Economic Paleontologists and Mineralogists, at the Clark Hotel, 6 P.M. Chairman, J. M. Hamill.

Exploration Activities and Results in California, by Roy M. Barnes, Continental Oil Co.

November 8

The Role of Formaminifera in the Oil Industry, by Herschell L. Driver, Standard Oil Co. of Calif.

Geology of the del Valle Field, Newhall District, California, by Richard W. Sherman, British American Oil Prod. Co.

Interpretation and Application of Electric Logs, by R. W. Norton, Standard Oil Co. of Calif.

Geology and Gas Potentialities of Marysville Buttes, by Harry R. Johnson, Consultant.

Recently Discovered Deep Miocene Production in the Inglewood Oil Field, by A. F. Woodward, Stanley and Stolz.

Seismic Velocity Variations in the San Joaquin Valley, by W. S. Olson, The Texas Co.

The Stevens Sand, San Joaquin Valley, by Rollin Eckis, Richfield Oil Corp.

Ecologic Factors in Correlation, by J. E. Eaton, Consultant.

Friday Evening, November 8.

Dinner Dance at the Fiesta Ball Room, Ambassador Hotel, 8:30 p.m.

Well Planned For Mc Kittrick Area

Reported as taking over a 20 acre lease from Calstan Petroleum Co. in the McKittrick area, Ebert E. Smith is planning a well in the near future.

Early in the year Calstan abandoned a 1220 ft. hole near the northeast corner of sec. 34,30-22 after recovering some oil from tar sands but failing to stop water entry. Tulare tar sands were marked at 880 ft. in this hole with the San Joaquin clays found near 1130 ft.

Santa Mora Starts No. Belridge Well

Santa Mora Oil Co.'s long planned test well in sec. 10,28-20 is officially under way after making a technical spud with a portable rig. Located two miles southwest of North Belridge field limits, the test seeks a new oil pool.

Installation made by Northern Division of Southern California Gas Company

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Coastal District

Cal. Alliance Deepens Ventura Avenue Outpost

Indicating that possibilities of the north central area of Ventura Avenue are far from exhausted, California Alliance Petroleum Corp deepened its Hartmann Ranch No. 1, 102 ft. to 7657 ft. and recompleted flowing 400 bbls. a day of 32 gravity oil and 425,000 cu. ft. of gas. At the time of the gauge, a 24/64 in. bean was in use which maintained a flow pressure of 330 lbs. Success of this job will probably stimulate new work in this portion of the field.

Other independent activity in this virtually major company controlled pool includes two projects of Lloyd Corp. which are approaching completion stages and British American Oil Producing Co.'s Hartmann No. 11, now drilling below 5000 ft.

Largest recent new well is Shell Oil Co.'s Taylor No. 110 which, bottomed at 8290 ft. and with formation open at intervals below 7550 ft., established a potential of 2610 bbls. a day. Location of the big producer is half a mile west of the Avenue.

Signal Pet. Deepens Hopper Canyon Well

With the drilling contracted to Fife Brothers of Long Beach, Signal Petroleum Co. is deepening the old Hadley No. 7 below 1000 ft. in Hopper Canyon.

Ventura Activity Still Increasing

With the dying out of the Los Angeles Basin booms during the past six months, Ventura county activity took a decided turn for the better and is still increasing. Although results of the speeded drilling tempo have so far lacked a great deal of being sensational, new production has been developed at Shiells Canyon, Hopper Canyon, and Ojai and indications are that even more favorable results will be obtained in the easterly section of the old South Mountain field. At the present time larger and more substantial companies are looking over the territory and it is probable that the county generally will undergo a better type of exploration in the future as nearly all work up to now has been carried on with the handicap of inadequate financing.

Prominently mentioned of late have been Hawaiian-American Exploration Co. which plans to drill a mile west of Oxnard and Mohawk Petroleum Co. which has taken leases near Fillmore. Bond Development Co. expects to start a Rincon outpost on the Tomson property while in Eureka Canyon, south of Piru, Oilexco, Inc., is drilling its second core hole.

Four Wells Active In Shiells Canyon

Four wells at present are active in the Shiells Canyon field, three of which are on property of Calumet Oil Co. Temulac Oil Co., whose name is a reversal of the spelling of Calumet, is deepening the old No. 7 well, formerly bottomed at 2900 ft. O. C. Field Gasoline Corp. is preparing to go ahead in well No. 3 after cementing 9 in. casing at 2555 ft. and Santa Clara Petroleum Co. is below 2600 ft. with 7 in. casing cemented at 2519 ft.

Fourth of the group is The Texas Co.'s Shiells No. 140 which is drilling at 2300 ft.

Costa Mesa Well Plans Tar Zone Test

With 11¾ in. casing in the hole, Milton N. Thompson's Banning No. 1 at Costa Mesa soon will be tested in the shallow Tar Zone from which many thousands of barrels have been produced in the past 30 years. Though not fully cored, the horizon is shown by the electric log to extend from 1080 ft. to 1230 ft. which is sufficient to support production unless the oil is too low gravity to enter the hole in commercial quantities as has been the case in some wells in the area.

If production cannot be readily obtained from the upper sand, trials will be made of other horizons down the hole, the best of which appears to be the 600 ft. above bottom at 5649 ft. The latter interval is probably lower Miocene and, according to the operator, offers a fair chance for production.

At the present time there are no wells producing in the entire Newport area, the low price of heavy oil plus high production costs having caused abandonment of old wells as they declined and became wet.

S. Mountain Wells Await Cal. Sec. Test

Immediate drilling of at least two wells in the easterly section of South Mountain awaits only a favorable test of the California Securities Oil Co. well in sec. 17, 3-20. Drilled to 4501 ft. and plugged to 4246 ft., it pumped for several days before mud and water broke in necessitating remedial work. As oil was used for circulating fluid while drilling, the exact amount of formation oil recovered remains unknown, but for a time the well had all the earmarks of a good producer. Difficulty has been experienced in elimi-

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
Santa Barbara County					
Elwood	Bolsa Chica Oil Co., Permit	191-7	24, 4-29	900	Drilling
Summerland	Barnato Corp., The, Hyland	1	16, 4-26	3475	Drilling
San Luis Obispo County					
Huasna	Tex Harvey Oil Corp., Gilmore Comm.	1	11, 32-14	3140	Drilling
	Superior Oil Co., Tar Springs	1	24, 32-14	6215	Drilling
Ventura County					
Bardsdale	Elkins, Reed	1	5, 3-19	800	Idle
	Hopland Oil Co.	1	1, 3-19		Rig
	Westoil Corp.	1	6, 3-19	550	Drilling
Conejo	Sulphur Springs Oil Co., Janss	1	33, 2-19	4526	Prep. to deepen
Ojai	Seaport Oil Corp., Arnett	3	15, 4-21	2121	Idle
	Norwood Oil Co., Coronet	2	17, 4-21	1750	Drilling
	Norwood Oil Co., Coronet	3	17, 4-21		Grade
	Per-Col Oil Co., Anlauf	6	21, 4-21	1877	Idle
Sespe	English, J. A., Lankershim	4	13, 4-9		Location
	Inter-Counties Fuel Co.	1	22, 4-19	150	Drilling
	Merchants Pet. Co., Cochrane	8	1, 4-20	2805	Pumping 80b/d
	Riley, Irene Burson	1	18, 4-19	2050	Idle
	Rio Hondo Oil Co., Cosby	1	14, 4-19	1695	Idle
	Signal Petroleum Co.	7	13, 4-19	1000	Drilling
South Mountain	Bolling Oil Co., Schieferle	1	17, 3-20		Grade
	Calif. Securities Oil Co., Schieferle	1	17, 3-20	4501	Testing
	Comstock Pet. Co.	1	17, 3-20	130	Idle
Sulphur Mt.	Madison Oil Co., Delphy	1	24, 4-22	2100	Drilling

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nating the trouble but the situation should clear up within a short time.

One location north of California Securities, Comstock Petroleum Co. made a technical spud and is standing idle while to the south, Bolling Oil Co. plans to start work as soon as steady production is obtained. Several other companies have tentative plans for entering the area.

Merchants No. 8 Pumps 80 Bbls. Daily

Cochrane No. 8 which Merchants Petroleum Co. recently deepened to 2805 ft. now pumps eight hours a day with production averaging 80 bbls. of 20 gravity oil cutting 3.0%. The well is located near Sespe Creek in sec. 1,4-20.

Bardsdale Wildcat Recovers Some Oil

Taking over the old Basola well in sec. 5,3-19 half way between Bardsdale and Shiells Canyon, American Seamless Tube Co. cleaned out to plugged bottom at 2918 ft. and put on the pump for an estimated five to ten barrels of oil a day. A fault was encountered in the bottom of this hole which is believed to have cut off most of the oil sand and the company is said to be planning another well.

More Valley

Greeley Field Well Flows 5225 Bbl. Rate

Finished in Vedder oil sand at 11,510 ft., Standard Oil Co.'s KCL No. 11-24 in sec. 18,29-26, was finished with potential rate of 5225 bbls. The clean 35 gravity flow rate was established through a 20/64 in. bean under 1700 lbs. tubing pressure and 1600 lbs. casing pressure. Gas was metered at 3,725,000 cu. ft.

Top of the Rio Bravo sand was found at 11,307 ft. while the Vedder was found at 11,347 ft.

Completing at press time was Standard's KCL No. 12-12 in sec. 7,29-26 while No. 12-11 was drilling at 10,000 ft.

General Petroleum Corp.'s Oughton No. 2, sec. 12,29-25, is reported drilling at 10,980 ft. Rig has been built and a drilling contract let to Bell & Loffland for Oughton No. 3 and rig is also up for Sullivan No. 3 in the same section.

Superior Oil Co. has re-entered Greeley development by starting Moore No. 2 on sec. 12,29-25. Depth of the hole was last reported as 9100 ft.

(Continued from Page 23)

not be necessary to start deflecting above 6000 feet. Hard formations sometimes make it advisable to start sooner. In some fields excessive drift angles cannot be used and this fact must be taken into consideration when planning the course of the well.

Key seating caused by the drill pipe being pulled through the deflected hole often discourages deflection at shallow depths It is difficult, moreover, to straighten a hole and then drill a thousand feet or more of vertical hole to bottom after making the necessary deflection at a shallow depth. It is often found hard to keep the hole straight under those conditions since the bit may not drill effectively or mechanical trouble may develop.

In redrilling operations or where a vertical well is unproductive a favorable location to start the directional drilling procedure is first selected. Old wells should first be surveyed to determine the exact point below ground. The hole is plugged and casing in the hole at and around this point should be pulled, if possible. If the casing cannot be pulled the most favorable point in the casing is selected and after setting a whipstock, a window is milled out and the deflection started through it.

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Experiences in the Cathodic Protection of Submarine Pipe Lines

C. N. G. A. Meeting
October, 1940

By Gordon N. Scott

I. Introduction

A submarine pipe line, requiring for installation the use of sturdy barges, tugs, launches and other equipment and depending on the diver's skill in the difficult jobs of properly placing the pipe, of making connections, and for inspecting the completed work, is expensive to lay and to maintain. Sea water is corrosive to iron and its degree of corrosivity is indicated by the life of from 8 to 12 years of heavy-weight pipe in submarine service.

Futhermore, the high cost of close and frequent inspection and of repairs and the consequences of oil spilled in channels and in harbors invites cathodic protection. Accordingly, the use of cathodic protection as a practical means to prolong the life of submarine pipe lines is worthy of earnest consideration.

The method is, of course, not alone restricted to marine pipe lines but has application to many submerged structures such as steel pipes or H-beams used as piles in wharfs and piers. Further, the method is obviously extensible to metallic pipes and structures in rivers, lakes, and other bodies of water. Similarly, use has been made of the process for the protection of the interiors of water tanks boilers, condensers and the like but these applications are beyond the present discussion.

Since the electrical protection of submarine pipe lines and other metallic structures submerged in sea water is so economically attractive, it is the purpose of this paper to discuss a number of cases of marine corrosion in which the corrosion has been allayed through the powerful medium of the electric current.

II. The Elements of a Typical Installation

In order that the reader may have a clear understanding of the electric process of corrosion mitigation, a brief discussion of the conventional or typical cathodic protection installation follows.

The elements of an installation are few. It comprises a pipe line (the cathode) to be protected, a ground bed (the anode), and a direct current source connected by wires or leads to the anode and to the cathode. The direct current is forced to discharge from the anode, to pass through the electrolytic medium of soil or water, and to accumulate on the pipe line. The passage of current through an electrolytic medium to or from a metallic conductor is accompanied invariably by a chemical change which in the case of the pipe line is primarily the decomposition of water. A portion of the hydrogen of water is liberated as a gas and hydroxide or alkali accumulates immediately about the pipe line.

A problem of the cathodic protection engineer is to fix for minimum annual cost the installation or number of installations so as to distribute most economically the current discharge from the anode in protective density over the whole extent of the line which it is desired to protect. The factors governing the distribution of the current on the pipe line are: (1) the resistivity of the soil or of the environment which property ranges from approximately 25 ohm-cm in the case of sea water to 100,000 ohm-cm or more in well drained soils and dry sands; (2) the pipe coating resistance which may range from zero in the case of a bare pipe to infinity (perfect insulation); (3) the pipe conductivity which varies with the weight per foot of the pipe; and (4) the geometrical relationship between the pipe and the anode.

The amount of electrical energy expended is greatly affected by the anode. Scrap iron, junk pipe, or carbon rods are usually used for anodes, although chemical anodes are under development; and the amount of anode used is determined in part by the resistivity of the soil, the life expectancy of the anode, and the unit cost of power.

III. Characteristics of Marine Installations

The environment in the case of submarine pipe lines is naturally limited to sea water, and to sea water saturated sand or mud. In all cases so far encountered the electrical resistance of these environments has been low (less than 200 ohm centimeters) whereas corrosive soils may range from these low values to 3000 ohm-cm and higher.

The pipe used in marine construction has usually been of heavy weight, with a wall thickness in the neighborhood of ½ inch. On the other hand cathodic protection permits the use of pipe in a weight consistent with mechanical requirements, in that added metal as a means of allaying corrosion is unnecessary.

Because of the former necessity; of early abandonment or replacement of marine pipe lines due to the rapid corrosion in salt water, abandoned pipe lines,—monuments to the corrosivity of sea water—are sometimes available when new construction is involved, for use as anodes in the cathodic protection of the new facility. In these cases, wherein a considerable body of metal is available as anode, and even in those cases where small anodes are laid in the salt water environments, a low resistance or high conductance of the anode is invariably encountered, a desirable condition sometimes quite impossible even to approximate in anodes laid in soil.

While salt water anodes, high in conductance, are favorable from the power consumption point of view the high conductance imposes upon the direct current source the necessity for close control in d-c out-put.

Invariably, and unlike cross country pipe lines, marine pipe lines are electrically isolated. The pipe lines either extend from the shore to a sea terminus, or cross channels. In all instances, insulating flanges are provided at the shore, or at each channel end of the pipe lines, to prevent the detrimental galvanic currents from discharging from the submerged portion of the pipe line.

Since a source of power has been always closely available, cathodic corrosion-eliminators have been consistently used in the cathodic protection of marine structures. The function of the corrosion-eliminator is to convert the high voltage, alternating current supply to direct current at a low voltage and at an amperage capacity satisfying design requirements. For marine work, because of the

* The writer acknowledges the cooperation of Electrical Facilities, Inc., Oakland, California, in providing Cathodic Corrosion-Eliminators satisfying the special demands of marine installation.

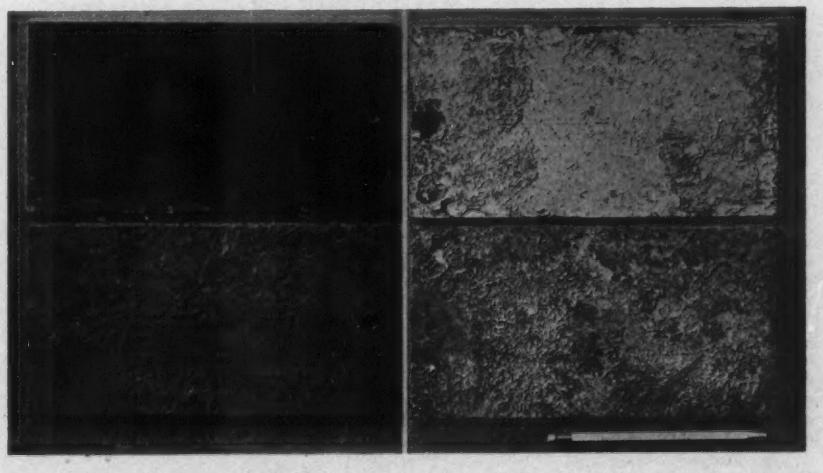

Figure 1. The pair of test coupons on the right contrast the cathodically protected specimen (above) covered with a current induced deposit with scale of normal sea water corrosion (below). The reverse faces of the specimens are compared on the left where the protected specimen (above) shows the original cleaning scratches while the unprotected plate (below) shows a pitted condition over the surface.

very low direct current voltages needed, corrosion-eliminators of special design* wherein is provided means for securing a low maximum d-c voltage and means for the close regulation of this voltage are required. The corrosion-eliminator, subjected to a salt water atmosphere, must be adequately safe-guarded against atmospheric corrosion. This protection has been accomplished by coating the selenium rectifying elements with a special material and by plating with cadmium all copper link-switches, lugs and other parts.

IV. Review of Some Installations

The pertinence of the foregoing discussion on the special features of marine installations and on some of the problems confronting the design engineer are best illustrated by a description of a number of installations.

CASE 1.

In 1930 a submarine and wharf line was laid across the channel at the San Pedro Marine Terminal. The line consisted of 42.33 pound 8⅝ inch pipe, having a wall thickness of 0.487 inches, all welded and treated when laid with a coating consisting of petrolatum and an organic wrapper.

From a point under one wharf the pipe line enters the channel vertically, drops to a depth of 52 feet, crosses 306 feet of the channel about 12 feet below the mud line, and emerges vertically to a wharf across the channel. Insulating flanges under both wharfs isolate electrically the channel portion of the pipe line from the rest of the system.

In September, 1937, the risers were inspected by a diver who reported a poor condition of the coating and the presence of much rust and of many pits which ranged in depth from 50 to 190 mils.

On January 4, 1938, cathodic protection was placed in operation. The installation consisted simply of a cathodic corrosion-eliminator the d-c circuit of which was connected to the pipe line and to an anode. The anode consisted of a 4-inch pipe header placed along an oil pipe line support on the wharf and to which header was welded on ten foot centers nine 4-inch laterals forty feet long.

The risers were again inspected in May, 1938, by a diver who reported that the pipe was now encased in a hard, whitish gray scale, ¼ to ⅜-inch in thickness, and on top of which were barnacles. The evolution of hydrogen gas was also noted by the diver. These observations are quite unlike those formerly reported and show the desirable effects of the current.

To test the efficiency of cathodic protection two sets of test coupons weighing about 5 pounds each were installed on both risers in March, 1939, and removed in March, 1940. One of each pair of the weighed specimens was attached to the pipe line and was thus protected by the electric current; while each of the companion coupons was merely suspended, free of electrical connection to the pipe line, adjacent to the attached specimens. During the submergence period the attached specimens remained entirely free of rust while the unattached pieces were each covered with rust and pitted and were each found to have lost 3% of its total weight.

The coupons illustrated in Figure 1 were laid in March, 1940, and removed for present purposes in September, 1940. In the right hand portion of the figure the attached and unattached coupons are shown as they appear before cleaning. The lower specimen is covered by a tenacious black scale overlaid by a thinner reddish brown layer of rust. Upon the addition of a strong acid the scale effervesces and the marked odor of hydrogen sulfide suggests microbiological anaerobic corrosion. The hard, whitish gray scale, reported by the diver, was deposited on the upper specimen as a result of the chemical changes caused by the passage of the electric current from the sea water to the cathodic plate. In the left hand portion of the figure are shown the opposite faces of the specimens which have been freed of scale. The surface of the unattached rusted specimen is pitted while the surface of the protected specimen is not pitted. The protected specimen when first removed for inspection was found to be entirely free of any indications of rust whatsoever.

The risers, emerging vertically from the channel, permit of easy testing both from the point of view of accessibility and of the theory of potential distribution. Accordingly very complete tests have been run on this pipe line to study the effect of cathodic protection in its relation to time.

Some of the interesting facts, relating in part to these tests, are as follows: The original coating on the risers had a measured resistance of from ½ to 2 ohms per square foot. At both risers, at any time, while the corrosion-eliminator is in operation, the evolution of hydrogen gas caused by the current can be observed. Also, both risers are now covered by the scale noted by the diver and may be seen at low tide. But after more than two years of protection to this line no very marked increase in resistance of the coating has been noted although the initial current of 14 amperes has now dropped to 11 amperes at the same voltage of 0.9 volts and this indicated increased resistance in the external circuit falls within the range of the unit coating resistance of ½ to 2 ohms noted above. The average current density on the pipe surface is roughly 13 milliamperes per square foot and the distribution of the current is approximately three to one or a minimum on the riser remote from the anode of about 6.5 milliamperes per square foot to a maximum of about 19.5 milliamperes per square foot on the riser adjacent to the anode.

CASE 2.

In October, 1938, 2200 feet of an 8-inch oil loading line was successfully launched in Monterey Bay. There was in the bay at that time a live 16-inch pipe line and also an adjacent 8-inch pipe line which had to be abandoned because of corrosion. The 16-inch line and the abandoned 8-inch line diverged from the shore line to a separation of approximately 100 feet at the termini which are at a depth of approximately 50 feet.

The pipe lines for a short distance at the inshore portion of the bay rest in sand but from there to the termini the pipe lines are supported on a rock shelf. That a coating on the pipe line, which was to be constructed and coated on shore and dragged seaward into place, could withstand the process of laying and the subsequent hazard of puncture by the rocks was questioned. But since preliminary tests indicated that the abandoned line could be successfully used as an anode for the new line and that no hazard would be created to the 16-inch line, cathodic protection was accordingly planned. Thus the novel feature of this pipe line installation is the use of well-coated, light-weight pipe with supplemental cathodic protection.

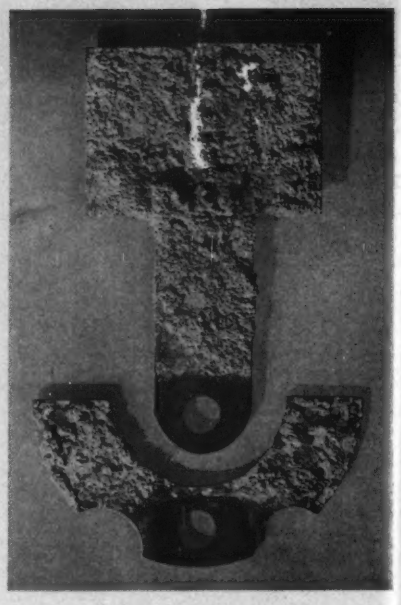

Figure 2. The test plates on the straight metallic arm were cathodically protected at the end of a submarine pipe line at —55 feet. Similar unprotected test plates on the curved insulating arm below were corroded away within one year. Note small barnacles in the bolt holes.

Before the line was launched angle slips were welded to the end of the line and to these slips the diver affixed temporary test leads and rope guides supported by cedar buoys. By means of special clamps, similar leads and buoys were affixed to the 16-inch line for purposes of test; but before the tests could be run most of the buoys with their leads had been torn loose by the high seas encountered in the bay.

After the pipe line was placed in the bay, the average resistance of the coating was found upon measurement to be approximately 2200 ohms per square foot. The rate of change with time of the conductance of the coating due to abrasion, to absorption of salt water, or to deterioration is not well understood in the case of coatings in sea water. Accordingly a corrosion-eliminator having about five times the estimated necessity amperage capacity was installed and placed in operation on February 4, 1939. The unit was set to deliver approximately 10 amperes at 0.7 volts. The cost of energy is about fifty cents a month.

In addition to the difficulty of maintaining test connections on submarine pipe lines where seas are heavy, considerable annoyance is experienced in attempting to read delicately balanced instruments. A further problem is the necessary communication with shore which in this instance was accomplished with poor satisfaction by means of visual flag signals.

CASE 3.

About August, 1936, a submarine loading line was launched in Estero Bay. The pipe line from the insulating flanges, which were located 600 feet from the

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shore line, consisted 3600 feet each of two parallel uncoated 56.07 pound 10¾-inch pipe lines approximately eight feet apart. A "U", to which the hose was attached, was flange connected by a diver to the ends of the parallel pipe lines. The line terminus lies about 55 feet below low mean water.

Preliminary steps were taken in July, 1938, to place this line under cathodic protection but it was not until March, 1939, that the corrosion-eliminator was finally placed in operation.

Two anodes, one on each side of the pipe line and perpendicular to it and each comprising 500 feet of scrap pipe, were laid horizontally along the beach in sand always salt water saturated. To insure complete utilization of the metal of the anode, each length of pipe was welded to the next and was at the same time attached to continuous anode leads. Thus the loss of any length of pipe due to corrosion would not seriously affect the resistance of the entire anode.

The "split" anode was used to improve the distribution of the current over the pipe lines. The current leaving each anode is separately metered in the corrosion-eliminator in order to measure the current discharged from each of the opposed anodes.

Metered power for the corrosion-eliminator was taken at 110 volts and transported for 3000 feet to the beach at 2200 volts to minimize power losses.

Communication was available for purposes of test through on existing submarine telephone cable.

As in the case of the Monterey installation, testing at the terminus was complicated by the inability to maintain in the high seas buoyed leads and by the difficulty of reading the sensitive meters. However, the telephone cable was in some instances used to advantage as leads in that connections at sea could be made to the pipe line and the instrument readings taken on shore.

In order that the effect of the cathodic current could be noted at the sea end of the pipe line two sets of test coupons, illustrated in Figure 2, were installed at one of the flanges on the "U" connecting the pipe lines. On one outside edge of the flange a metallic arm was held in place by one of the flange bolts. At the upper end of the metallic arm two small test coupons, ⅛-inch thick, five inches long and four inches wide, were connected, and being thus metallically connected through the arm to the pipe line were under cathodic protection. At the other end of the bolt on the other outside flange edge was similarly attached an arm consisting of an old insulating gasket. Two like specimens were attached to this arm and being separated by the insulating arm from the pipe line the test plates suffered the normal corrosion of the salt water. These specimens were laid in August, 1939, and were removed in August, 1940.

The diver reported that one of the coupons attached to the insulated arm was entirely gone and that a jagged remnant of the second coupon remained, but when he reached for the latter it fell away from the support and was not thereafter recovered although an effort was made to find it. The protected coupons on the metallic arm, however, were recovered unimpaired and when brought to the surface were found to be covered with barnacles and entirely free of rust. Even the threads of the small bolts holding the plates to the arm were sharp and bright. Since the removal of the specimens, however, a small amount of rust, due to atmospheric corrosion accelerated by the salt water which was not immediately washed from them, has developed.

An attempt was made to examine the pipe line for evidences of scale deposit and for the possible evolution of hydrogen gas; but because the pipe line was covered with sand, except at the extreme end, and could not easily be located by the diver, no information on these points was obtained.

Unlike the specimens removed from the San Pedro Channel, which specimens were coated with a heavy, whitish, gray scale, the attached specimens showed no marked indication of lime deposit other than that attributable to the barnacles. It is likely, since the specimens probably

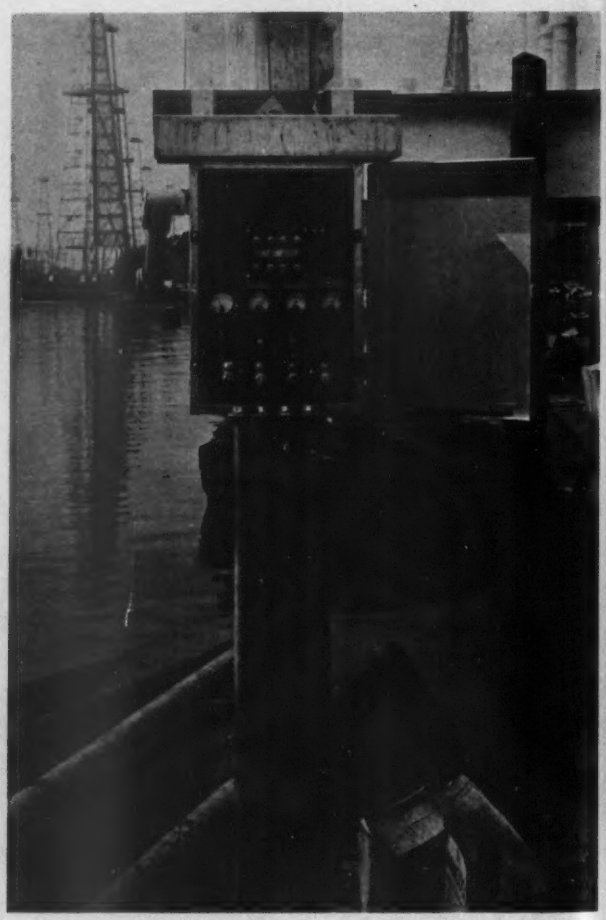
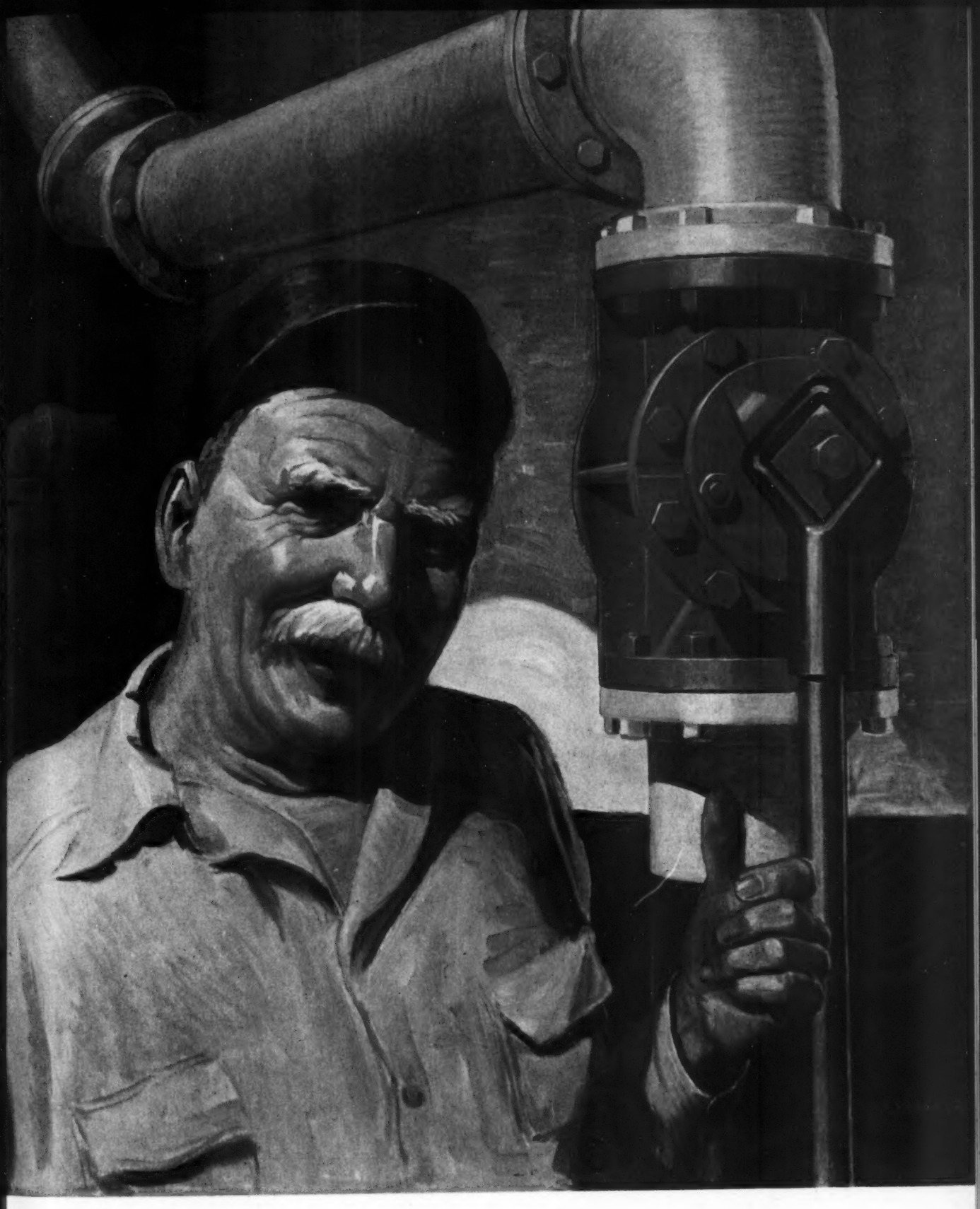


Figure 3. Special low voltage Cathodic Corrosion-Eliminator for protecting six parallel trans-channel pipe lines. Figure 4. Special three-phase half-wave Cathodic Corrosion-Eliminator with three resistance coupled d-c circuits.



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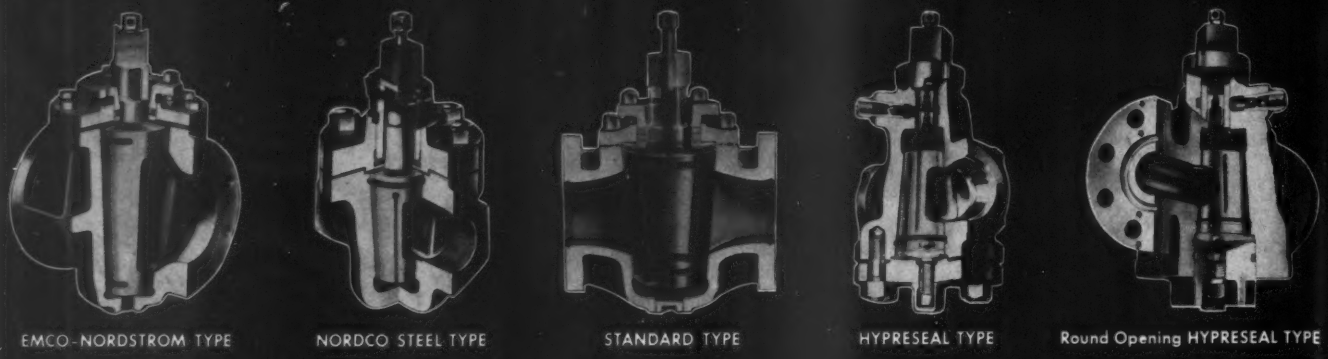

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remained in salt water during the year and were not covered with sand, that an opportunity for the accumulation of alkali and the subsequent precipitation of the salts of calcium and magnesium was not afforded. Nevertheless, the specimens show perfect protection due to the current.

The average current density on the pipe lines was approximately 9 milliamperes per square foot, but the density at the extremity of the line, as nearly as could be gauged by the tests, was between 2½ and 3½ milliamperes per square foot. This observation is particularly interesting in view of the fact that laboratory tests in static sea water indicate a current density requirement of 10 to 15 milliamperes per square foot and a current density need very much higher where aeration is encountered.

The power consumption of the corrosion-eliminator, which has a capacity of 200 amperes at 8 volts, is approximately 16,800 kilowatt-hours per year. Thus, there is an opportunity, in the light of the above experience, for a considerable annual saving in power costs. Polarization occurs instantly with the passage of the current from the environment to the pipe, but the dissipation of polarization may be largely a mechanical effect and would thus involve time as a factor. While such dissipation must be fairly rapid at the extremity of the line, which is exposed to the constant movement of water due to the tidal under currents, the rate of dissipation is likely much slower than the rate of formation. Further, it is possible that practically the entire pipe line will sooner or later become encased in a hard cemented material which is already in abundant evidence on the inshore portion of the pipe line. This encasement of cemented sand, which forms about the pipe, resembles a very poor grade of concrete. But the effect of this material in favorably altering the distribution of the current has not yet been quantitatively demonstrated. It is now planned to install a time switch which will be arranged to supply intermittently the corrosion-eliminator with power. This procedure, while saving possibly one-half or more of the current used, will, it is anticipated, be much more effective so far as protection per ampere is concerned than the use of one-half the total amount of current supplied continuously.

Because of the similarity of the results obtained from this installation with that of another with which the writer had little connection and because of the supporting evidence provided by the latter experience, the engineer's report, with minor editorial changes and a few comments, follows:

"Cathodic protection was applied three years ago to about 3000 feet of 16-inch by 9/16-inch wall submarine pipe line which had been laid in 1929. Inspection in 1935 disclosed that 700 feet of pipe between points 1000 feet and 1700 feet from shore was corroded to such an extent that it was replaced. In 1937 the pipe was again inspected and pit depth measurements were made. Considerable corrosion was found on the original pipe inshore from the replaced section, so a cathodic protection unit consisting of an undersea anode and a 200 ampere corrosion-eliminator was installed in December, 1937. This unit has been draining an average of 180 amperes continuously since that time. Electrical tests indicate that the protective current density on the most severely corroded section of the line, that is the section just inshore from the replaced section, ranges somewhere between 20 and 50 milliamperes per square foot, which is perhaps several times as much as is required to give complete protection in sea water.

"Inspection during the summer of 1940 failed to disclose any increase in the depth of pitting over that which had been observed in the previous inspection in 1937. The pipe was found to be heavily coated with white scale and cemented sand in the area of greatest current pick-up. The white scale was found to be as much as ¾ inch in thickness and the cemented sand and gravel extended about three feet above the pipe at one location."

The heavy scale was found on the pipe for about 1200 feet from the point where the negative lead was attached to the pipe line but a deposit was found over the rest of the pipe line.

"In order to have a check on the effectiveness of the installation a coupon test was started in June, 1938. Then 6-inch by 6-inch by 10 gage mild-steel test coupons were buried in water saturated sand near the pipe line at its inshore end. Half of these coupons were bonded to the line so as to place them under cathodic protection, and the remainder were left unconnected. The protective current density on the specimens was between 10 and 20 milliamperes per square foot. Two protected and two unprotected coupons were removed after 11 months of exposure and the remaining 6 were removed after 26 months of test.

"The weight losses of the coupons are shown below:

Coupon No.	Months of Exposure	Loss of Weight in Grams	Remarks
1	26	0.2	Cathodically protected
2	26	0.0	
3	26	0.3	
4	11	2.0	
5	11	2.3	
6	26	22.3	Not protected
7	26	18.2	
8	26	53.6	
9	11	5.8	
10	11	11.5	

"It is surprising that the weight loss of the protected coupons removed after 26 months was less than the loss from those removed after 11 months as there is no reason to suppose that any of the coupons received better protection than the others. The only difference in handling the specimens was in thoroughly cleaning and oiling the 26 month ones to make certain that no additional corrosion took place after removal from the sand. The 11 month coupons were shipped to the laboratory with the scale on them. Upon finding such a low loss on the 26 months protected specimens, they were again cleaned and weighed to check the loss. All of the protected specimens were coated with scale and several inches of cemented sand."

The average current density for this installation is approximately 14.5 milliamperes per square foot but the distribution of this current is not known to the writer.

CASE 4.

In March, 1939, a dual 12¾-inch 49.56 pound well-treated pipe line was launched from the coast near Santa Maria. This loading pipe was similar to the one previously described in that the two parallel pipe lines were looped at the sea terminus. The installation differed from the one previously described in that the pipe lines were well-treated; were largely supported inshore above the ground; and were terminated at storage tanks to which no other pipe lines connected.

The cathodic protection in this case was designed to supplement the treatment on the pipe lines; to protect the shore portions of the pipe lines necessarily buried; and in addition to include all shore tank bottoms.

Power in this instance is taken from a generator at the plant. Since only a small fraction of the power capacity of the generator is at present utilized no great expenditure for a low resistance ground bed, as was necessitated by the installation at Estero Bay, was indicated. If no abandoned line is available for use as anode and no wharf or piers are available from which to suspend anodes, their location on the shore necessitates an outlay which may become a sizable fraction of the total investment in cathodic protection.

In this case, five 6"x80" carbon anodes were set perpendicularly on 15 foot centers in a ballast pond adjacent to the pipe line near the shore. Two of the advantages of this procedure in comparison to the laying of steel anodes were, first, that the anode, consisting of carbon, is expected to have a long life, thus eliminating the necessity for frequent replacement; and, second, being few the carbon anodes are adapted to the small space available in the salt water ballast pond. Further, the initial expense of the usual anode installation was in this way avoided and the difference in cost extended into the future in the form of power charges. The three phase corrosion-eliminator, rated at 28 volts and 50 amperes, is at present operating at about 18 volts and 40 amperes.

In the light of the experience with the Monterey and Estero Bay installations, no attemot was made to fix temporary leads to the pipe line, but advantage was taken of the annual summer visit of the repair barge to make the necessary tests for design and control.

Communication with the shore was by means of radio.

CASE 5.

In the early spring of this year a joint enterprise consisting of a multiple pipe line system for the transportation of oil, gas, and water, across the entrance harbor to the Long Beach Channel was installed. The six pipe lines, consisting of pipe, ranging in diameter from 8⅝-inch to 14-inch and each identically treated with a substantial coating, were laid in the channel in three sections, consisting of a central portion and two shore sections. The central portion of the lines was flange-coupled to the shore units by a diver and it was thus not feasible to treat in any way the connecting flanges. Accordingly, cathodic protection was provided to protect at the outset the flanges against corrosion together with the bolts etc., and to protect whatever portions of the pipe which might be exposed due to damage to the coating in laying. Since the group of lines were owned by five separate concerns, the corrosion-eliminator was arranged as shown in Figure 3, separately to control and to measure the amount of current picked up by each pipe line. Six separate leads were brought from the pipe lines to the corrosion-eliminator and coupled to the cathode circuit in the corrosion-eliminator through resistance wire thus providing the feature of selective adjustability. Aside from a

meter indicating the total current through the rectifier, the separate pipe line circuits are arranged through appropriate shunts and a selective switch to read on a single meter the current on the individual lines.

The anode consisting of 120 feet of scrap pipe was laid in the channel at a point about 75 feet distant from the closest pipe line where it would be covered at low tide but at the same time be at such a depth as to be easily accessible for replacement when the metal of the anode is expended.

The 4-volt, 50-ampere corrosion-eliminator is at present operating at a d-c output of 1.25 volts and 9.5 amperes.

CASE 6.

A similar cathodic protection installation involving three cooperating companies was completed in March, 1940. In this case, however, the objective was to protect existing pipe lines comprising two 8-inch oil and one 6-inch gasoline pipe line and three power and one telephone cables all laid at separate dates and different in regard to protective coatings. In all, approximately 13 facilities, mostly abandoned, cross the entrance channel to the Long Beach Harbor at this point. One of the pipe line owners supplied one of the abandoned pipe lines as anode.

The possibility of telephone interference invited in this case the use of a three phase rectifier. However, the character of the installed pipe lines, together with the very low resistance afforded by the abandoned pipe line as anode, necessitated the use of a very low voltage corrosion-eliminator. Since the normal output voltage of a three-phase, full-wave corrosion-eliminator is 14 volts d-c, it was desirable (in order to reduce the d-c voltage) to utilize three-phase half-wave rectification of normal 7 volts d-c which rectification further differs from full-wave rectification in that a somewhat larger ripple component is present in the d-c current.

In order to further reduce and control the d-c output voltage regulation was furnished by means of three taps on the secondaries of the transformers and variable resistors in the primaries of the transformers, thus making possible continuous regulation over the entire d-c output range. In this case separate control in each of the three cathodic circuits was arranged, as in the previously described case, by the use of binding posts, adapted to receive adjustable resistances.

The corrosion-eliminator is shown in Figure 4. The studs and bus in the center of the panel provide for voltage regulation in balanced steps of the secondaries of the three-phase transformer while the dial in the upper right hand corner actuates series resistances in the primaries of the transformer to control the potential applied to the selenium rectifying elements.

This corrosion-eliminator has a rating of 2 volts and 50 amperes and is at present operating at a d-c output of 0.9 volts and 33 amperes.

CONCLUSIONS

While details on the cost of these several installations have been omitted from the discussion, it is none-the-less quite evident from a consideration of the components of the several installations that the over-all costs must be very low in comparison to the pipe line investment involved in each case.

The cost of power is well nigh negligible in all but the one case of the Estero Bay installation; and even in this case, a much larger power charge could very easily be justified in view of the assured extension in pipe life. Efficiency of the corrosion-eliminator is a negligible factor, again excepting the Estero Bay case where high efficiency in the rectifying equipment is quite important. The necessity and advantage of operating the corrosion-eliminators at very low voltages greatly reduces their efficiency but no importance attaches to this fact since the power consumption is such a negligible factor.

Under present operating conditions a comparison between the installation and the power charges for the Estero and Monterey Bay installations would seem to indicate that the cost of the added coating would be paid out in a very short time by savings in power charges and also in cost of the anode. This conclusion, however strongly indicated, is not yet warranted, since the minimum current needed for protection in the Estero Bay case has not been demonstrated. It is quite likely that in most instances a substantial coating would prove most economical but the problem cannot be generalized since conditions are so different in the several cases. Each problem must be separately analyzed in the light of its own special situation.

Other tentative conclusions, however, seem to be warranted on the basis of the data presented. In the first place savings in marine pipe line installations may be effected through the use of cathodic protection in that pipe of a weight satisfying mechanical requirements may be safely used since positive protection is afforded the pipe. In the second place there now seems little economic justification in installing or maintaining marine structures without cathodic protection, wherever properly applicable, since reliance upon its effectiveness may be complete.

The author wishes to acknowledge the courtesy of the nine or more companies owning or operating the facilities discussed in the foregoing pages for their generous permission to make use of the information which is in reality their property.

C. E. Olmsted Named Head of Texaco Export

Harry T. Klein has been elected executive vice president and general counsel of The Texas Co. at a meeting of the board of directors, W. S. S. Rodgers, president, announces. Mr. Klein has been vice president and general counsel of the company since 1933. Mr. Rodgers at the same time announced that C. E. Olmsted, vice president in charge of the company's refining department, who was recently elected a director, has been placed in charge of the export department, and that Michael Halpern, general manager of the refining department, has been elected a vice-president to assume Mr. Olmsted's position in charge of that department. All three men have had long and distinguished careers with Texaco.

Colonel Klein, who served in France, becoming an officer of the French Legion of Honor, and who holds the American Distinguished Service Medal, became associated with The Texas Co. in 1921 as a member of the legal department. He was elected general counsel of the company in 1925, vice president in 1933, and was elected a director of The Texas Co. and the Texas Corp. in 1935. Later that year he also became a member of the executive committee.

Mr. Olmsted, who in his new post will supervise The Texas Co.'s widespread foreign sales and production activities, joined Texaco in 1919 as an engineer, after serving with the United States Army. In 1923 he resigned to become associated with California Petroleum Corp. at Los Angeles, becoming vice president and director in 1927. When that company was acquired by The Texas Co. in 1928, Mr. Olmsted was elected vice president of The Texas Co. (California) in charge of refining and later of producing. In 1929 he was made vice president and general manager and in 1934 president and general manager. Since 1938, Mr. Olmsted had been vice president in charge of the refining department of The Texas Co. (Delaware).

Mr. Halpern takes charge of the refining department after twenty-four years' service in that branch. He joined Texaco in 1916, became civil engineer at the Bayonne Terminal in 1917 and less than four years later assistant superintendent at the Providence Terminal. In 1923 he was made superintendent of Delaware River Terminal, and in 1926 was transferred to Houston as auditor of operations, subsequently serving as an assistant superintendent at the Port Arthur Works, assistant manager of the refining department, with headquarters in New York, and as manager of manufacturing. He also acted for a time as director of research and in September, 1938, was appointed general manager of the refining unit.

G. B. Taylor Appointed Menasco Mfg. Purchaser

G. B. Taylor, who as purchasing agent for The Petrol Corp. was the subject of encomium from the pen of literary Paul Drus in our Second Issue of June, 1940, has recently transferred his abilities to a field of great timely interest in taking over the job of manager of purchases for Menasco Manufacturing Co., makers of military aircraft training ship engines. The company has a large backorder for Ryan of San Diego and for the Canadian government.

You are reading the Pacific Coast oil men's home paper.

Production « « » » Development

(Figures of Production and Stocks are in barrels of 42 Gals.)

	Total Production August	—DAILY AVERAGE— Aug., 1940	July, 1940	Aug., 1939
Group No. 1				
Arvin	44,803	1,445	1,749	1,733
Belridge—North	331,184	10,683	10,187	12,200
Belridge—South	63,376	2,045	2,152	1,240
Canal	171,461	5,531	5,543	5,729
Canfield Ranch	1,042	34	36	90
Coalinga	873,773	28,186	28,047	20,284
Cole's Levee	123,499	3,984	3,624	1,194
Edison	68,875	2,222	2,371	2,207
Elk Hills	373,324	12,043	12,289	10,447
Fruitvale	176,115	5,681	5,665	6,203
Greeley	144,430	4,659	4,009	2,275
Kern River	347,476	11,209	10,684	11,764
Kettleman Middle Dome	.....	.....	.....	26
Kettleman North Dome	1,450,354	46,786	46,731	52,219
Lost Hills	113,584	3,664	3,683	3,411
McKittrick	120,268	3,880	3,593	3,793
Midway-Sunset	1,539,512	49,662	49,948	49,724
Mountain View	198,277	6,393	6,472	8,101
Mount Poso	285,104	9,197	9,151	10,674
Paloma	15,432	498	507	8
Rio Bravo	282,781	9,122	9,473	7,335
Round Mountain	230,289	7,429	6,939	8,569
Strand	49,655	1,602	1,580	340
Ten Section	304,208	9,813	9,508	9,398
Tupman	113,731	3,669	3,565	499
Wasco	44,769	1,444	1,582	1,355
Wheeler Ridge	9,664	312	302	323
Group No. 2				
Capitan	53,339	1,721	1,675	2,339
Elwood	105,840	3,414	3,428	4,155
Rincon	145,081	4,680	4,633	2,630
San Miguelito	100,555	3,243	3,167	2,779
Santa Barbara	7,275	235	207	268
Santa Maria	303,397	9,787	7,262	6,250
Santa Maria Valley	571,782	18,445	18,582	10,065
Summerland	927	30	24	27
Ventura Avenue	1,073,696	34,635	34,070	35,579
Ventura-Newhall	250,968	8,096	7,393	7,034
Watsonville	775	25	25	30
Group No. 3				
Brea-Olinda	180,313	5,816	5,848	5,725
Coyote—East	120,177	3,877	4,433	2,665
Coyote—West	247,394	7,980	7,779	9,133
Domingues	688,429	22,207	21,424	17,868
El Segundo	62,976	2,031	2,156	2,980
Huntington Beach	786,717	25,378	24,988	25,475
Inglewood	358,369	11,560	11,873	12,566
Lawndale	1,040	34	42	45
Long Beach	1,337,739	43,153	43,329	45,215
Los Angeles-Salt Lake	16,094	519	533	572
Montebello	542,195	17,490	18,887	23,350
Playa Del Rey	126,255	4,073	3,995	4,722
Potrero	59,030	1,904	1,532	1,244
Richfield	285,641	9,214	9,186	8,751
Rosecrans	401,514	12,952	14,190	10,627
Santa Fe Springs	809,033	26,098	26,221	27,238
Seal Beach	210,612	6,794	7,142	7,115
Torrance	325,552	10,502	10,526	15,933
Whittier	6,153	199	185	932
Wilmington	2,600,670	83,893	82,726	85,833
Total	19,256,524	621,178	616,851	610,786
July	19,122,398	616,851		
Increase	134,126	4,327		

	New Rigs Up	Producers Active Drilling	Producers Completed	Daily Initial Output	Active Producing	Abandoned Wells Drillers	Abandoned Wells Producers
Group No. 1							
Arvin	..	....	....	....	16	....	....
Belridge—North	..	2	2	1,190	72	....	....
Belridge—South	..	....	....	....	184	....	....
Canal	1	1	....	....	33	....	....
Canfield Ranch	..	....	....	....	1	....	....
Coalinga	11	23	5	12,997	857	....	....
Cole's Levee	4	4	1	690	25	....	....
Edison	1	....	2	137	97	....	....
Elk Hills	..	....	....	....	193	....	....
Fruitvale	..	....	....	....	171	....	....
Greeley	2	4	2	3,596	33	....	....
Kern River	..	2	....	....	1,558	....	....
Kettleman North Dome	3	9	2	552	267	....	....
Lost Hills	..	....	....	....	276	....	....
McKittrick	..	....	1	80	203	....	....
Midway-Sunset	3	6	3	234	2,543	....	1
Mountain View	..	1	....	....	184	....	1
Mount Poso	1	2	1	200	295	....	....
Paloma	..	2	....	....	3	....	....
Rio Bravo	4	8	3	4,415	59	1	....
Round Mountain	2	2	1	350	222	1	....
Strand	..	1	....	....	9	....	....
Ten Section	4	4	3	4,814	56	....	....
Tupman	2	13	4	4,580	23	....	....
Wasco	..	1	1	3,052	12	....	....
Wheeler Ridge	..	1	....	....	34	....	....
Group No. 2							
Capitan	..	....	....	....	41	....	....
Elwood	..	....	....	....	74	....	....
Rincon	..	3	....	....	64	....	....
San Miguelito	1	1	....	....	23	....	....
Santa Barbara	..	....	....	....	19	....	....
Santa Maria	..	2	....	....	176	....	1
Santa Maria Valley	1	2	1	82	144	....	....
Summerland	..	1	....	....	8	....	....
Ventura Avenue	2	7	4	7,647	323	....	....
Ventura-Newhall	3	8	2	1,436	527	....	....
Watsonville	..	....	....	....	7	....	....
Group No. 3							
Brea-Olinda	..	....	1	33	355	....	....
Coyote—East	1	4	1	168	84	....	....
Coyote—West	..	....	1	105	62	....	....
Domingues	4	5	2	605	188	....	....
El Segundo	..	....	....	....	43	....	....
Huntington Beach	3	4	3	2,086	541	....	1
Inglewood	..	1	....	....	212	....	....
Lawndale	..	....	....	....	5	....	....
Long Beach	4	3	4	283	1,221	....	3
Los Angeles-Salt Lake	..	....	....	....	103	....	....
Montebello	1	....	2	461	323	....	1
Playa Del Rey	..	....	....	....	156	....	2
Potrero	..	....	1	322	19	....	....
Richfield	1	2	1	65	305	....	....
Rosecrans	2	5	4	1,084	164	....	....
Santa Fe Springs	..	....	....	....	591	....	....
Seal Beach	1	....	....	....	119	....	....
Torrance	..	....	1	80	649	....	8
Whittier	..	....	....	....	38	....	....
Wilmington	13	11	14	5,479	866	....	....
Miscellaneous Drilling	6	30	....	....	....	6	....
Group No. 4—Gas Fields							
Buena Vista Lake	..	....	....	....	1	....	....
Buttonwillow	..	....	....	....	6	....	....
Chowchilla	..	....	....	....	....	....	....
Delano	..	....	....	....	14	....	....
Fairfield Knolls	..	....	....	....	....	....	....
Goleta	..	....	....	....	....	....	....
Marysville Buttes	..	....	....	....	3	....	....
McDonald Island	..	....	....	....	5	....	....
Rio Vista	..	1	....	....	22	....	....
Semi-Tropic	..	....	....	....	....	....	....
Tracy	..	....	....	....	4	....	....
August	81	176	73	57,423	14,931	8	18
July	75	172	86	96,438	14,921	20	24
Increase (*Decrease)	6	4	13*	39,015*	10	12*	6*

SUMMARY OF CALIFORNIA OILFIELD OPERATIONS FOR AUGUST, 1940—STOCKS HELD IN PACIFIC COAST TERRITORY BY CALIFORNIA OIL COMPANIES

	Aug. 31, 1940	July 31, 1940	August Changes	Aug. 31, 1939
1. Gasoline-Bearing Crude	36,360,453	36,116,475	+243,978	37,876,094
2. Non-Gasoline-Bearing Crude	12,818,762	13,217,848	−399,086	14,266,375
3. Unblended Nat. Gas	2,765,839	2,627,668	+138,171	2,246,222
4. Gasoline (not including distributing and service stations)	14,458,803	14,831,909	−373,106	13,331,736
5. Naphtha Distillates	1,960,407[1]	1,888,095[1]	+ 72,312	1,450,221[1]
6. Gas Oil and Diesel Oil	10,112,598	9,857,816	+254,782	10,116,384
7. Fuel Oil Residuum	63,600,163	64,319,349	−719,186	69,779,076
8. All Other Stocks	8,804,958[2]	9,021,682[2]	−216,724	7,517,674[2]
TOTAL	150,881,983	151,880,842	−998,859	156,583,782
[1]Estimated amount of unfinished gasoline in item 5	1,732,886	1,689,155		1,172,235
[2]Coke included in item 8	1,167,955	1,208,275		478,374

LAUGH THIS OFF

In an outburst of patriotism, a small western town has organized a home regiment. By-laws have been drawn up in two sections, as follows: "Article First. This regiment shall be known as the Muddletown Rifles. Article Second. In case of war, this regiment shall immediately disband.

And we have often thought that if wars could be staged as spectacles in the regular football stadiums, they wouldn't last so long. Under such circumstances neither side could long withstand the charges.

Whereupon, **John Woodward** tells us about a Taft oil man who was recently converted at a revival meeting. It has so changed his way of living, that on Sunday now he always carries his golf clubs under his coat.

On this same subject, **Dub Russell** says conceit may be a terrible thing, but you can't expect the winner of a golf trophy to take it home through an alley.

Charlie Sherertz, on the other hand, notices that a man never drops into your office to talk golf on Monday morning, unless he won on Sunday.

And since her husband took to divot lofting and made her a golf widow, a Whittier lady refers to him as "the late Mr. Glutz".

A politician, so we are told by **Duke Thornburg,** was recently bitten by a dog, and sued the owner, an oil man, for a substantial sum. The latter, conducting his own defense, said he expected to establish his innocence by proving, 1st, That his dog was of such exemplary habits it would not stoop to biting a politician; 2nd, That it was blind and couldn't see to bite; 3rd, That even if it could see to bite, it would be impossible because of its lameness; 4th, That even if its eyes and legs were good, it had no teeth; 5th, That the dog died six weeks before the politician was allegedly bitten; 6th, That he never had a dog.

All of which recalls the significant fact that the sailors call a shark a "sea lawyer".

By the way, you must never attempt to make a lawyer swallow his words. They might choke him.

And **Spud Tyler** recites this intriguing remark by a disconsolate rousty. Says he to his buddy, "Bill, I've taken the pledge, but how would it be if you mixed a cocktail and forced me to swallow it."

Liquor is a terrible thing. Coming home the other morning real early, we saw an oil man who shall be nameless trying to walk on both sides of the street. It was only by a very skillful maneuver that we were able to walk between him.

Then there was the lad who decided to cut down and swore that henceforth he wouldn't drink another drop from the time he went to bed until he got up.

Fred Smith here interrups to cite the case of an old Bakersfield couple, who, as a result of a local oil strike, suddenly found themselves rich. The first thing they did with their new found wealth was to buy a piano stool, and were they disappointed when they turned the crazy thing up as far as it would go and down as far as it would go, but couldn't get a single note out of it.

Also, just demonstrating the fact that troubles never come singly, **Ike Burroughs** recounts a calamitous sequence of events that hit a local operator. On the very same day, this poor guy ran out of chewing tobacco, and then learned that his wife had run away with an equipment salesman.

And when Junior saw his first tortoise, he yelled, "Hey, pop, looky. Here's a toad with a cover on it".

All of which brings us mercifully to the end of another weird session. Remember, there is no more lonesome guy in this world than a yes man. He no's nobody.

And just what it means we don't know, but it appears that "you can't make a silk purse out of a souse's ear.

ONLY COMPLETELY DRILLABLE MATERIALS ARE USED IN THE INTERNAL CONSTRUCTION OF BAKER FLOATING UNITS.

Purchasing Personalities

By Leo S. Busby
Associate Editor
Southwest Purchasing Agent

TIDE WATER ASSOCIATED OIL CO.

The entrance to the building at 610 South Main Street in Los Angeles is the open sesame to come of Southern California's most worthwhile experiences. From there, via the Pacific Electric's red speeders, you may enjoy the orange show at San Bernardino, the county Fair at Pomona, the races at Santa Anita, the Rose Parade at Pasadena, the glamorous inducements of Catalina, and the varied attractions of dozens of other beautiful towns and cities of the southland. And, if you're not excursion minded at the moment, but simply crave a congenial interlude of most pleasurable conversation, or perhaps, peddle a machine bolt or two, you have only to take the elevator to the seventh floor, and step into the office of James Holly Hayter, Assistant Purchasing Agent of the Tide Water Associated Oil Company, Western Division, in charge of the Southern office.

"Holly," as he is popularly known among his wealth of friends, hails from the "show me" state of Missouri, a fact which possibly accounts for much of his inherent purchasing acumen. He was born in Stockton, Missouri, a few years before the bombastic twentieth century blitzkrieged the calendar. His early education was in the public schools of the region. The name "Holly," by the way, is not a family name, as you might suppose, but was given to him because, like Christmas holly, he was delivered three days before Christmas on a cold, bleak Missouri day.

It was in 1909 that J. Holly Hayter exchanged Missouri for California. He went to work for the old Associated Oil Company, at Oil Center, California, as a clerk in a field office. His next step was a transfer to the Associated Supply Company, at that time controlled by the Associated Oil Company. During the following eight years he worked in the supply and oil business as a clerk and stenographer, and finally as storekeeper. Then he was sent up to the headquarters office at San Francisco where he was made a buyer and later chief clerk in the purchasing department of the Associated Oil Company.

In the fall of 1922, when the company opened buying offices in Los Angeles, Holly was sent down here to take over. The purchasing headquarters of the company's Western Division are still in San Francisco, and Mr. Hayter, as Assistant Purchasing Agent, reports directly to A. P. MacKillop, Purchasing Agent, at San Francisco.

James Holly Hayter is a rather short, well-built individual, and, like most short men, what he lacks in height he makes up in energy and enthusiasm. He is most congenial, an excellent conversationalist, and has the knack of making you feel like you've known him for years. He's the kind of fellow you'd like to have along on a fishing or hunting trip deep into the mountains.

It surprised us a great deal to learn that Holly is still a bachelor. He has maintained a home for himself and mother for many years here in Southern California.

Golf is Holly's favorite "while-away" and from all reports he has long since divorced himself from the lowly divot diggers. He's a member of the Nine-

Holly Hayter

teeners, and was president of those rounders a couple years ago. He plays a mean pitch hand as other members of the L. A. Purchasing Agents' Association will heartily attest. He didn't show us any snapshots or any stuffed beauties, nor did he tell us about the big one that got away, but he does occasionally hie himself to the High Sierras to stalk the wily trout with rod and reel.

If we're not mistaken, it was Andrew Carnegie who said that the smart executive surrounds himself with assistants who have initiative and intelligence, and who can assume responsibility. In Martin Newell, Holly Hayter has exemplified his executive adroitness.

Martin is Holly's right hand man and acts as office manager and head buyer. He has been in the company's employ since 1918 when he started as a warehouseman with the Associated Supply Company in Los Angeles. After a period as store manager at Santa Fe Springs, he came to the purchasing department of Associated as a buyer in 1922. His particular worry at this time is the purchase of oil well supplies.

Martin Newell is a native of Marshfield, Wisconsin. His hobby is fishing, both deep in the ocean and high in the mountains. He never played much football but he has the build of a fullback, and all in all, if the going gets tough, we'd say that Holly Hayter has a mighty handy man around.

The third member of the Los Angeles buying staff is C. A. Ball, who is a native of Toronto, Canada. He too has been associated with Associated from way back, having left the Union Hardware Company in 1923 to join the Associated organization. He is a specialist in service station equipment, hardware, electrical supplies, and sundry other sundries. Like his confreres, Mr. Ball professes to a weakness for fishing but, for the sake of variety, throws in a little gardening on the side. And this, to us, is an ideal set-up. You dig in the garden on Saturday and then use the worms for fishing on Sunday. Not bad!

In visiting the Tide Water Associated purchasing department in Los Angeles you get the impression of a well-knit, compact, efficient organization. It consists of only five members, all of whom have been with the company over fifteen years, including the two ladies who handle the stenographic and clerical details. Definitely, there is a quiet, friendly, purposeful atmosphere about the place.

Incidentally, "my friends," have you seen the new 1940 Associated Football Schedule? Holly Hayter gave us a handful and we're telling you football fans, the new schedule is really something. Among other things, it gives the games by dates and by stadiums; it carries schedules of every conference in the west and includes the independents; it shows the games to be broadcast and gives the kilocycles of all the broadcasting stations. We understand the schedules are available at all Smiling Associated Dealers.

If you haven't already heard it announced, this is the fifteenth consecutive year of Associated's Pacific Coast Football Sportcasts. And that, fellow wave-lengthers, calls for you and us to say most heartily: "Congratulations, Associated, and thanks—from us millions!"

New aid to rotary drillers in finding oil-bearing formations is the ultra-violet ray. Inventors say it detects instantly minute quantities of oil invisible to the naked eye in drilling muds.

Springs of synthetic rubber products will replace those of metal, it is believed, and air conditioning, now almost universal in intercity motor coaches, will be installed.

Baash-Ross Tool Co. Promotes B. Bronzan

B. Bronzan, sales manager of Baash-Ross Tool Co., has been given the additional post of assistant general manager,

B. Bronzan

according to an announcement made by L. F. Baash, president of the company. Mr. Bronzan, who has had long service with the company, has advanced steadily through the various departments to his present position. His headquarters will continue to be the Los Angeles office, although he will, as in the past, cover the other plants and service branches of the company by periodic trips.

Leeds & Northrup New Thermocouple Fitting

To facilitate thermocouple replacement, a Universal Union for angle-type couples has now been adopted by Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia. The two halves of this union fit snugly together in a ground joint making it vapor and fume-tight. By unscrewing a single clamping nut—which cannot fall off—the thermocouple's hot leg can be detached; or it can be rotated to any angle between 90 degrees and 180 degrees, and locked firmly in place.

BJ Friction Grip Surface Casing Elevator

Byron Jackson Co. is offering a Friction Grip Elevator for handling surface casing, or large diameter water strings where the load is not too great.

The design of the body and door is

similar to that of the standard BJ Side-Door Elevators. However, since the type of casing to be handled has no collars, it is necessary that the elevator have a powerful, evenly distributed friction grip. This has been accomplished by means of a machined inner bore (which may be wickered) and a special latch and take-up mechanism. The latching device consists of a built-in pinion roller which meshes over an eccentric rack cast into the door. The tighter the latch is clamped the more firmly the elevator grips the casing because of the tightening effect of the eccentric rack. This gripping action is controlled by the take-up screw which pulls the latch inwardly toward the pipe. A cross arm washer on the take-up screw fits into a saddle-like recess in the latch, so that the take-up screw can be unfastened only by unscrewing the take-up screw nut. Jars and blows will not cause it to release.

The BJ Friction Grip Elevator is made to order only as the inner bore must be machined to accommodate the type of surface casing to be handled.

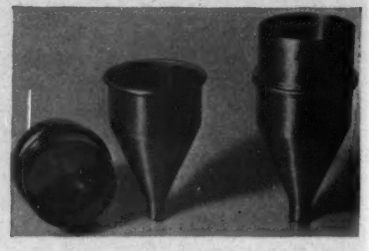
Specifications can be had by addressing your inquiry to Byron Jackson Co., P. O. Box 2017 Terminal Annex, Los Angeles, California.

Baroid Screen Set for Sand Content Determination

The Baroid Sales Division now has available its new Baroid Screen set. This instrument provides a simple and extremely accurate means of determining the sand content of drilling mud.

A special 200-mesh sieve 2½ inches in diameter, a funnel to fit, and either an elutriation tube or a centrifuge tube comprise the entire instrument. Consequently there is no complicated assembling or dismantling necessary, the final results can be obtained much more rapidly, and the very simplicity of the apparatus minimizes the possibility of error not only in running the tests but in taking readings.

The elutriation method which has been the standard means of determining sand



content is quite practical but is susceptible to error because frequently particles which although finer than 200 mesh but having a specific gravity greater than 2.7 are not separated out by the wash water. As a consequence these particles remain with the sand particles and thereby cause a higher reading of the sand content than is actually the case. However, the very method of operation of the Baroid Screen Set eliminates this chance of error.

Furthermore, no calibration or readjustments are necessary to keep the apparatus in working order.

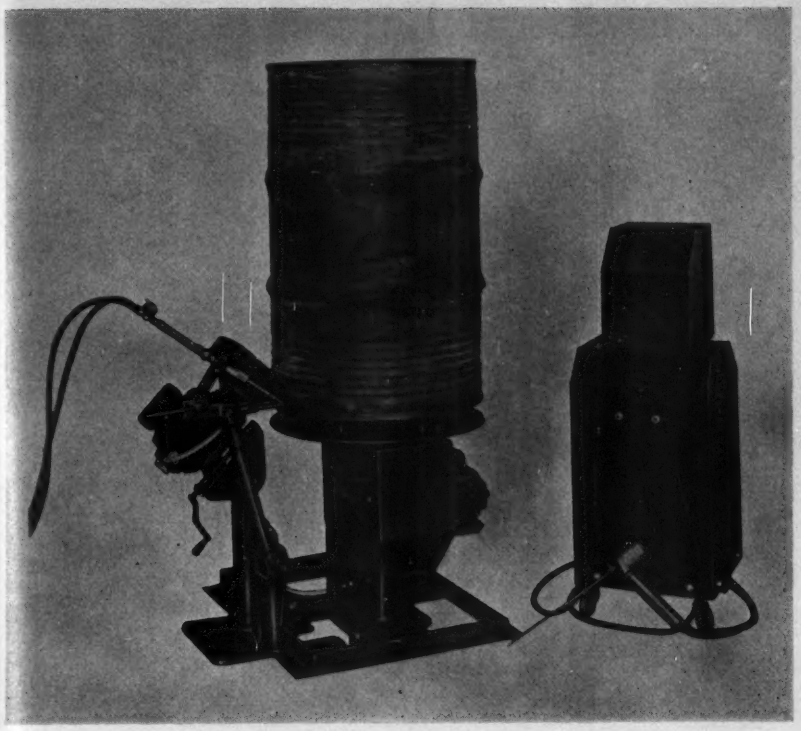
The ability to achieve accurate results from an instrument of simplified design enables the Baroid Sales Division to make the Baroid Screen Set available at a price extremely below that of former instruments used for sand content analysis.

Full information concerning price and details of operation of the Baroid Screen Set can be obtained by writing to the Baroid Sales Division, 830 Ducommun Street, Los Angeles, Calif.

High-Sensitivity G. E. Galvanometer

A new galvanometer, more than three times as sensitive as previous galvanometers, has been announced by the General Electric Co. The new instrument is suitable for many applications where wall types heretofore were frequently necessary. Applications include temporary setups for factory and laboratory testing; permanent installations for testing instruments, material, and apparatus for production, where rapid readings and minimum fatigue to the operator are essential; and for bridges and other apparatus requiring an external galvanometer.

The extreme sensitivity of this instrument is largely obtained by an arrangement of two fixed mirrors mounted inside the case, one on each end, thus increasing the effective light beam length. This gain in sensitivity is obtained at no sacrifice in sturdiness.



Metal Drums Repaired By Improved Process

Repairs are made on metal drums by a new improved process using equipment and methods announced by McClary & Byers Equipment Co., 1009 Fruitvale Avenue, Oakland, Calif. Although designed specifically for standard 55-gallon capacity drums fabricated from 14 to 20 gauge metal, the equipment is flexible in that it can be adapted for use with metal containers other than those fitting these specifications.

McClary & Byers equipment consists of a Drum Welding Machine with means for holding the drum in an upright position and at a 30-degree angle, revolving the drum in each position through a gear series giving high, low and neutral positions, and means for varying the high and low speeds by a variable speed pulley and train of gears to allow the welder selection of a revolving speed best suited to apply the weld. Mechanism is supplied for properly preparing the drum head seams for welding, and for cleaning weld-slag from the weld after completion, furnishing a clean surface for testing and painting.

A vibrating electrode holder enables the welder to hold a close and constant arc, necessary to secure a first class electric weld on a drum head seam. The Vibro-Arc holder simplifies the process to such an extent that experienced acetylene welders learn how to do an expert electric welding job in a very short time.

Supplied as part of the unit as a G-R Arc-Welding Machine with remote control, manufactured by Glenn-Roberts Inc., of Oakland, Calif. The machine is especially adapted for this type of work. It furnishes a constant and smooth arc. Heat control attached to the electrode holder provides the operator with close control, allowing heat changes as small as one ampere at a time.

Head seams of galvanized drums are welded without any trace of discoloration or damage to the drum interior. Two other methods have been developed by McClary & Byers. One makes it possible to permanently repair leaks in the head seam without requiring a complete circumferential weld. The other allows permanent repairs in the head seam to be made by an exclusive alternate process without welding and without emptying a filled drum of its contents.

Personal instruction of welders by an experienced McClary & Byers operator is included with each installation.

Patent applications have been made, one patent having been issued and others pending.

Edward D. Maltby Co. Moves to Larger Quarters

In line with the growing importance of Southern California as an aviator, automotive, and oil tool manufacturing center, Edward D. Maltby Co., specialists in ball, roller and needle bearings, has just removed its quarters to its own building at 1718 South Flower St., Los Angeles. The new building will be one of the most modern of its type in the United States, and includes general offices, private offices, store and stock rooms, sales office, display rooms, literature and loading rooms, and free parking in the rear. It is a modern fire-proof structure designed by Hudson and Brockow, architects, with Joseph Clapper, as general contractor.

Edward D. Maltby Co. is backed by over 20 years of experience in the bearing field. The firm acts as factory representative for Marlin-Rockwell Corp., of Jamestown, New York, manufacturers of M R C Bearings, Shafer Bearing Co., of Chicago, American Roller Bearing Co., of Pittsburgh, Roller Bearing Co. of America, of Trenton, New Jersey, and the Chicago Rawhide Manufacturing Co., of Chicago. In addition, this company is a distributor of Timken Tapered Roller Bearings to the automotive replacement trade.

The Maltby Co. maintains one of the most complete stocks of bearings on the Pacific Coast and every attention will be given to the engineering phases of various industrial applications. Unbiased recommendations as to type are made possible by the many varied lines of merchandise carried. In other words, they will fit the right bearing to the right place, thereby making possible substantial savings.

Edward D. Maltby Co. is the outgrowth of a business founded in 1919 in San Francisco. A Los Angeles branch was opened in 1923 at 321 West Pico Boulevard. Gradually, as business grew, partitions were knocked out and ever larger quarters were taken. Five years ago the firm doubled the size of its old offices but growth of business has necessitated even larger quarters and a much larger staff.

Mr. Maltby was born in Jamestown, New York, and graduated in industrial engineering from Pennsylvania State College. During the war he was an ensign in the Navy and, just before his discharge, was made a junior lieutenant, with assignments to sub-chaser and destroyer duty. He is a member of the Society of Automotive Engineers and is an authority on all phases of the bearing business.

One of the unusual features of the new Maltby building will be a unique display room with murals depicting the major industries of Southern California. The room will be modernistic in style with large photos and displays of various manufacturers lines.

You are reading the Pacific Coast oil men's home paper.

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COMPLETE WILSON POWER RIG FOR SALE

Wilson Atlas Model Draw Works and Transmission with Automatic Cathead.
2—Waukesha Model LSU 225 H. P. 6 cylinder Engines—equipped to run on Natural gas or Butane.
7⅛ x 18 Wilson-Snyder 3000 pound Power Pump, fully equipped.
27½" Oil Well fully enclosed Oil Bath Rotary Table.
66" - 5 sheave Union Tool Roller Bearing Travelling Block.
8" Wigle Spring Hook.
6" 150 ton Oil Well type B Swivel.
6 Sheave Emsco Double Deck Roller Bearing Crown Block.
6¾ x 14 Oil Well Power Pump and PA-100 International Engine mounted as Standby unit.
Martin-Decker Quintuplex Weight Indicator.
McNeely Model 4-D-4 Mud Shaker.
Wilson Utility unit with 7½ K. W. Generator (for lighting rig and running mud shaker). Powered with Buda model H-217 gas engine.
Baroid Mud Tester, Stand Pipe, Butane Rack, Steel Sub Structure.
All of this equipment is in perfect condition and ready to run. Recommended for drilling up to 8,000 feet.
Call or write
H. & B. SALES CO., Ltd.,
2675 Cherry Avenue
Long Beach, California
Phone Long Beach 418-50

The best proof that even the smallest advertisement in the California Oil World is read, is that you are now reading this.

Oil Men's Calendar

Calif. Natural Gasoline Association. Los Angeles Chapter—Meets 1st Thursday Each Month, Barker Bros. Bldg., Los Angeles—Dinner at 6:00 (Optional). Taft Chapter—Meets Third Thursday Each Month.

American Society of Mechanical Engineers—Los Angeles Section—Meets 2nd Thursday Each Month—Barker Bros. Bldg., Los Angeles. Dinner at 6:30 (Optional).

October

24-26—American Institute of Mining and Metallurgical Engineers, Petroleum Division, Tulsa, Okla.

31-Nov. 2—Society of Automotive Engineers, National Aircraft Production Meeting (and Engineering Display), Biltmore Hotel, Los Angeles, Calif.

November

1—California Natural Gasoline Assn., Fall Meeting, Los Angeles, Calif.

7-8—American Association of Petroleum Geologists, Pacific Section, Los Angeles.

11-15—American Petroleum Institute 21st Annual Meeting, Stevens Hotel Chicago, Ill.

December

2-6—American Institute of Chemical Engineers, New Orleans, La.

9-14 — National Asphalt Conference, Dallas, Texas.

1941

January

6-10—Society of Automotive Engineers, Annual Meeting (and Engineering Display), Book-Cadillac Hotel, Detroit, Mich.

G. E. High Power Factor A-C Welder Line Extended

The General Electric Co. has added a new 300-ampere size to its line of arc-welding transformers with built-in power factor correction. As in the 500-ampere welder previously announced in this line, this new size offers all the advantages of high power-factor without sacrifice of stability or performance. Not only is useless lagging current practically eliminated under load, but at light loads or no load, power-factor correction for other plant load is provided. Smaller line cable, line switches and fuses can thus be used. This often results in savings on installation costs or makes possible the addition of more welders to existing feeders without causing overload.

Other advantages of this new 300-ampere welder include: finger-tip current adjustment; large easily-read current indicators; protected output terminals; and fan-forced ventilation. The refinement of design permits reduction in size, weight and floor space requirements. Thus the new welder is only 43 inches in height, only 21 inches in diameter, and has a net weight of only 450 pounds.

The only maintenance required is lubrication of the fan and current adjuster every 12 to 18 months, which can be done without removing the case of the welder. This new addition to the line of G-E arc welders with built-in factor correction was featured in the General Electric exhibit at the National Metal Exposition in Cleveland, Ohio, October 21-26.

New flying tank-plane combination armed with 90 mm. cannon is keeping U. S. Army designers busy. Russians originated the idea.